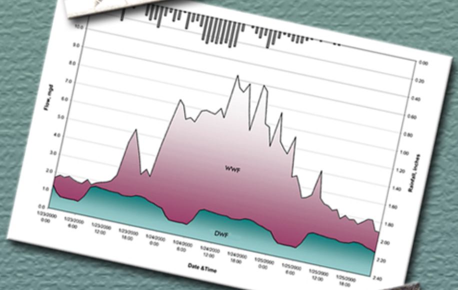
THE CITY OF PLEASANTON

FINAL

REPORT

Wastewater Master Plan

AUGUST 2007



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Wastewater Master Plan
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City of Pleasanton

WASTEWATER SYSTEM
MASTER PLAN

FINAL
August 2007

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City of Pleasanton

WASTEWATER SYSTEM MASTER PLAN

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EXECUTIVE SUMMARY

This executive summary presents a brief background of the City of Pleasanton (City) wastewater system, the need for this wastewater master plan, proposed improvements to mitigate existing capacity deficiencies, and proposed improvements for anticipated future growth.

ES.1 STUDY OBJECTIVE

Recognizing the importance of planning, developing, and financing wastewater system facilities to provide reliable and enhanced service for existing customers and to serve anticipated growth, the City initiated the preparation of this wastewater system master planning study.

The objective of the study included the following:

- Establish wastewater system design and planning criteria.
- Review temporary flow monitoring program and data performed by V&A Consulting.
- Evaluate the capacity of the existing wastewater collection system using computer hydraulic modeling.
- Review existing system and propose improvements to enhance system reliability.
- Recommend improvements needed to service anticipated future growth.
- Develop a Capital Improvement Program for the next 15 years, which includes cost estimates and project phasing.

ES.2 STUDY AREA

The City encompasses approximately 25 square miles and is located in central Alameda County. The City of Dublin neighbors to the north and the City of Livermore to the east. The City's estimated 2004 population was approximately 69,000 persons.

The City provided current land use data on a parcel level in GIS format (Figure ES.1). The City's Wastewater Master Plan identifies the infrastructure necessary to service lands within the current City boundaries and those that the City is planning on annexing. Land use data for these additional areas was determined using the City's database for vacant/future commercial parcels and the annexed/future residential parcels database (Figure ES.2).

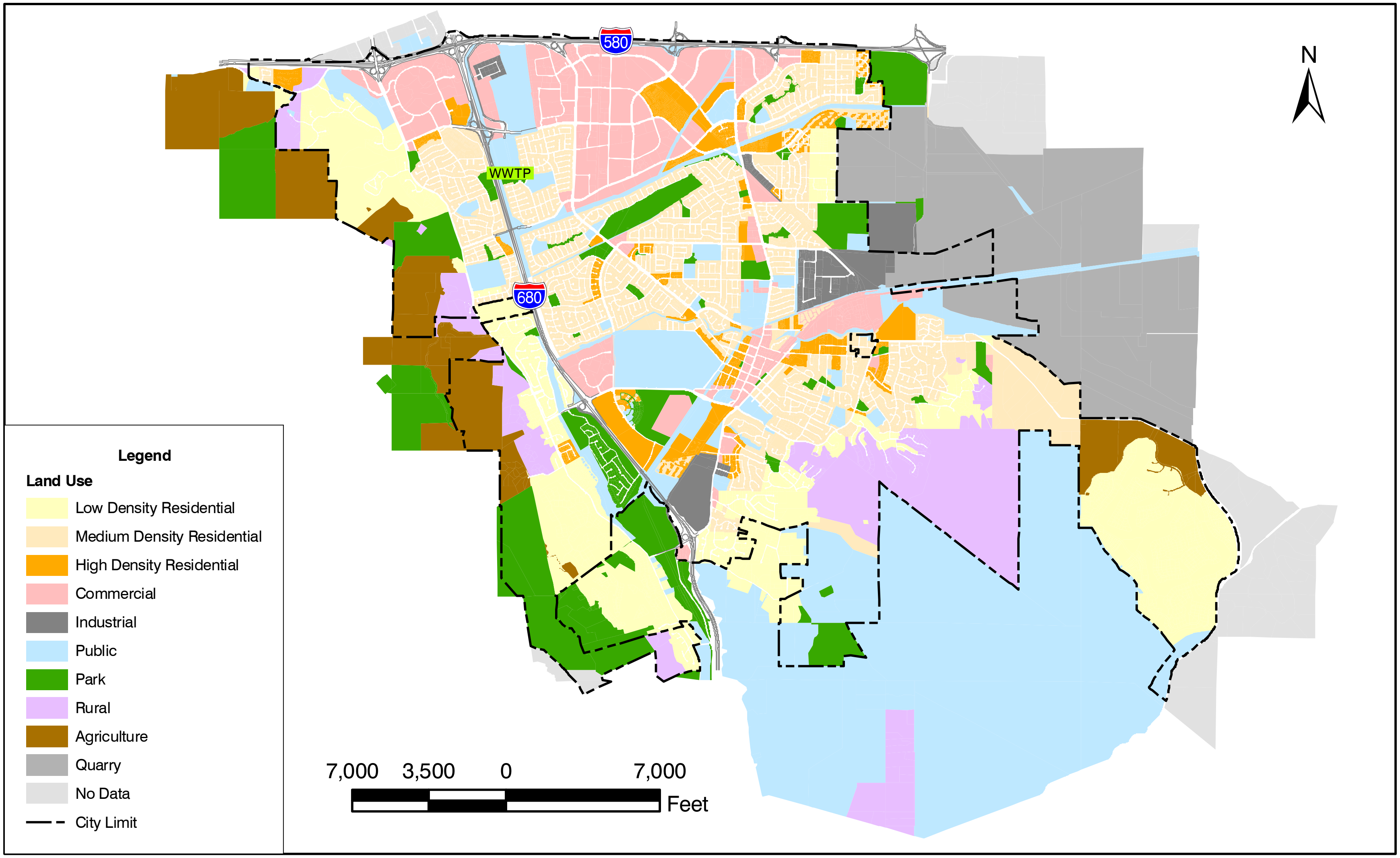

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Figure ES.1
EXISTING LAND USE
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

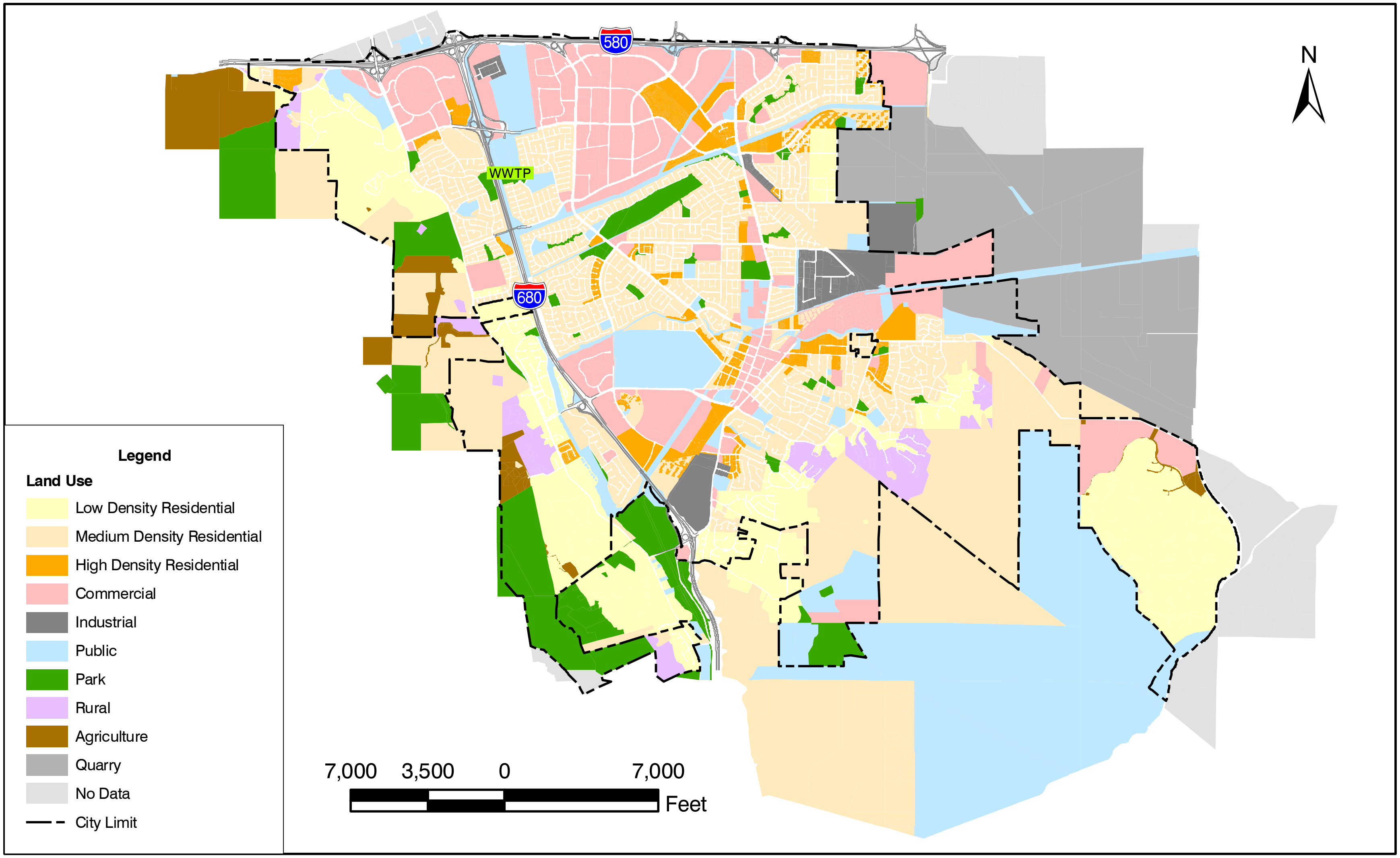

Figure ES.2
FUTURE LAND USE
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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ES.3 WASTEWATER SYSTEM OVERVIEW

The City's sewer collection system consists of approximately 270 miles of 4-inch through 36-inch diameter sewers. The "backbone" of the system consists of the trunk sewers, generally 10-inches in diameter and larger, that convey the collected wastewater flows to a Wastewater Treatment Plant (WWTP) operated by the Dublin San Ramon Services District. In accordance with an Interjurisdictional Agreement, a portion of Pleasanton wastewater flow is conveyed to the City of Livermore.

The City's sewer collection system conveys wastewater flows to the WWTP through a series of trunk sewers. Figure ES.3 illustrates the collection system as modeled for this study. The larger interceptors range in diameter from 18-inches to 36-inches and are the major tributary pipes to the WWTP. Vitrified clay pipe (VCP) comprises approximately 66 percent of the pipes. PVC pipe accounts for an additional 26 percent of the pipes in the system.

The City has four pipelines that are tributary to the WWTP. The Highland Oaks trunk sewer services the northwest area, the East Amador Trunk Sewer (EATS) serves the north and northeastern portions Pump Station S-6 forcemain services the central, southwestern and eastern areas, and Pump Station S-8 forcemain services the southern portion of the City.

In addition to these four pipelines, the City has two other pipelines of significance. The East Amador Relief Sewer is a currently inactive sewer that parallels the EATS line along Stoneridge Drive. The Cross-Town interceptor is used as a means to reroute flow in the eastern portion of the City. The 1992 construction of this pipeline eliminated several pump stations and allowed this area of the City to flow by gravity.

ES.4 WASTEWATER REQUIREMENTS

Historical flows at the WWTP were reviewed and analyzed to determine daily, monthly, and seasonal fluctuations experienced by the sewer system. The City's future sewer requirements were estimated and capacity adequately determined using design flow criteria. The DWF were estimated by applying land use coefficient factors, and a 10-year 24-hour storm event was used to simulate the wet weather flows (WWF).

ES.4.1 Dry Weather Conditions

During existing dry weather conditions, the average and peak hour flows from the City are 5.3 and 8.4 mgd, respectively. At future conditions, the average and peak hour dry weather flows are anticipated to approach 7.5 and 11.6 mgd, respectively.

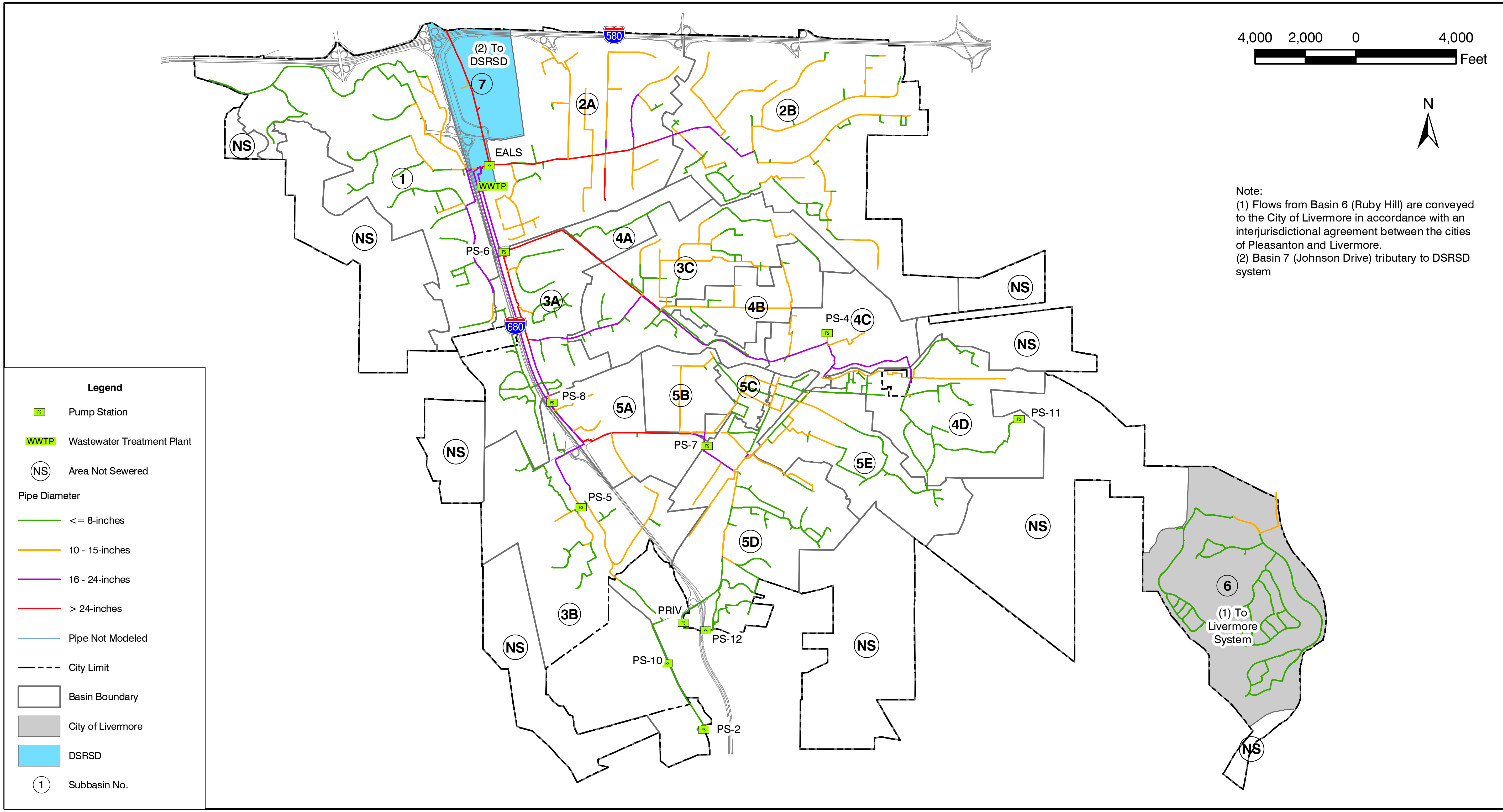

Figure ES-3
MODELED COLLECTION SYSTEM
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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January 30, 2005

ES.4.2 Wet Weather Conditions

Wet weather flows are based on infiltration and inflow (I/I) entering the sewer system. The hydraulic model used peaking factors to introduce wet weather flow components in the sewer collection system. Evaluating the capacity adequacy of the City's sewer system included applying a hypothetical 10-year 24-hour design storm that increased the experienced I/I.

The hydraulic model projects peak hour flows of 17.0 mgd and 21.5 mgd for existing and future conditions, respectively during a 10-year 24-hour design storm. These projected wet weather flows assume no mitigation to the current I/I rates.

ES.5 WASTEWATER SYSTEM EVALUATION

The City's wastewater system was evaluated based on the analysis and design criteria defined in this study. A hydraulic sewer model was assembled and used in evaluating the adequacy of the City's sewer system (Figure ES.3). The hydraulic model combines information on the physical characteristics of the sewer system (pipe sizes, pipe slopes, etc.), and performs calculations to solve a series of mathematical equations to simulate flow in pipes.

The proposed projects consist of new or increased capacity pipelines that are needed to convey peak wet weather flows to the WWTP. These proposed improvements, which are discussed in detail in the report are phased to provide an economical and realistic approach to implementation.

ES.6 CONCLUSIONS

The analysis of the City's existing sewer system indicates that the collection system was well planned to meet the needs of existing customers. The City's collection system has adequate capacity to convey dry weather flows (DWF) with few deficiencies. Capacity deficiencies under WWF conditions represent less than 10 percent of the modeled collection system. The relatively few number of deficiencies can be attributed to a well designed system without significant I/I problems.

ES.7 CAPITAL IMPROVEMENT PROGRAM

The cost estimates presented in the Capital Improvement Program (CIP) have been prepared for general master planning purposes and for guidance in project evaluation and implementation (see attached Capital Improvement Budget Summary). Final costs of projects will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as: preliminary alignments generation, investigation of alternative routings, and detailed utility and topography surveys.

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore, the Estimated Construction Costs include a 30 percent contingency to account for unforeseen events and unknown field conditions. The CIP also include an additional 35 percent (applied to the Estimated Construction Costs) for project-related costs, comprising of engineering, administration, construction inspection, and legal costs. The CIP contingencies were applied as directed by City staff.

The required improvements for the recommended CIP are presented in Figure ES.4. The CIP construction and total project costs are summarized in Table ES.1 and total $17,867,000.

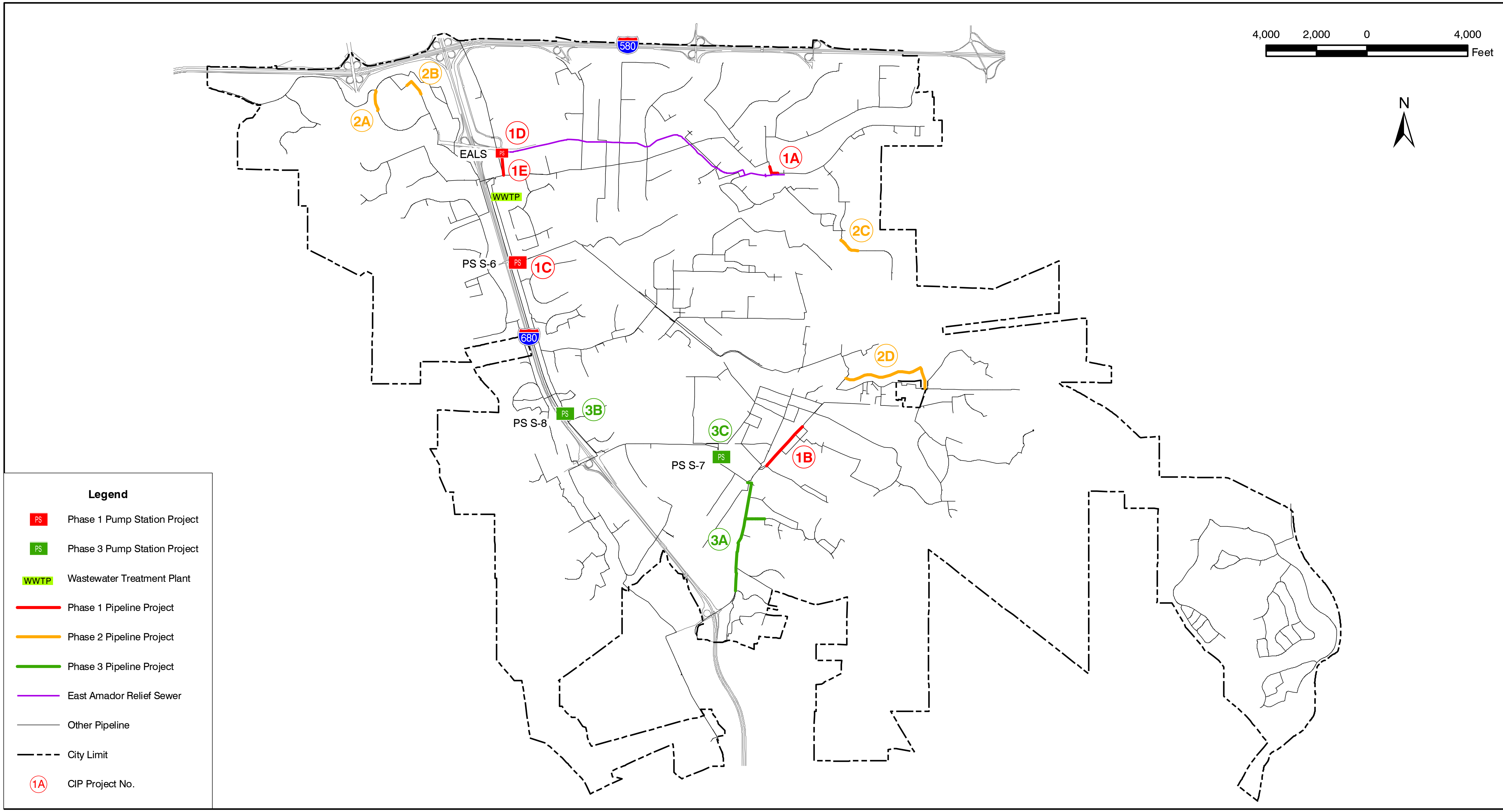

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Figure ES.4
RECOMMENDED CAPITAL IMPROVEMENT PROGRAM
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

Table ES.1 Capital Improvement Program Costs
Wastewater System Master Plan
City of Pleasanton

Project	Description	Project Type	Diameter (Inches)	Quantity	Units	Estimated Direct Construction Cost ($)	Construction Contingency[1] ($)	Admin/Legal/ Construction/ Engineering Contingency[2] ($)	Estimated Total Project Cost[3] ($)	2003 Dry Weather Flow (mgd)	Future Dry Weather Flow (mgd)	2003 DUE[4] (DUE)	Future DUE (DUE)	DUE Increase (DUE)	Percent Existing Customers (%)	Percent Future Customers (%)	Estimated CIP Cost Existing Customers (%)	Estimated CIP Cost Future Customers (%)
Phase 1 - Near-Term																		
1A	Santa Rita Road Sewer	Pipeline	15	522	LF	$112,000	$34,000	$39,000	$185,000	0.2	0.4	843	1,633	790	51.6%	48.4%	$96,000	$89,000
1B	First Street Sewer	Pipeline	12	2,120	LF	$433,000	$130,000	$152,000	$715,000	0.4	0.5	1,820	2,067	247	88.1%	11.9%	$630,000	$85,000
1C	Rebuild PS S-6	Pump Station	---	6.9	MGD	$2,500,000	$750,000	$875,000	$4,125,000	2.0	2.7	9,233	12,091	2,858	76.4%	23.6%	$3,150,000	$975,000
1D	EARS PS	Pump Station	---	7.6	MGD	$3,000,000	$900,000	$1,050,000	$4,950,000	1.6	1.9	7,149	8,778	1,629	81.4%	18.6%	$4,031,000	$919,000
1E	EARS Connector Sewer	Pipeline	18&30	1,600	LF	$587,000	$177,000	$205,000	$969,000	1.6	1.9	7,149	8,778	1,629	81.4%	18.6%	$789,000	$180,000
Phase 1 Total						**$6,632,000**	**$1,991,000**	**$2,321,000**	**$10,944,000**								**$8,696,000**	**$2,248,000**
Phase 2 - Medium-Term																		
2A	Stoneridge Mall Bypass	Pipeline	8	850	LF	$143,000	$43,000	$50,000	$236,000	0.1	0.2	537	861	325	62.3%	37.7%	$147,000	$89,000
2B	Nordstrom Sewer	Pipeline	8	860	LF	$144,000	$43,000	$50,000	$237,000	0.1	0.1	446	624	178	71.4%	28.6%	$169,000	$68,000
2C	Kamp Drive Sewer	Pipeline	10	855	LF	$161,000	$48,000	$56,000	$265,000	0.0	0.2	84	799	716	10.4%	89.6%	$28,000	$237,000
2D	Vineyard Sewer	Pipeline	18	3,972	LF	$909,000	$273,000	$318,000	$1,500,000	0.3	0.5	1,457	2,056	599	70.9%	29.1%	$1,063,000	$437,000
Phase 2 Total						**$1,357,000**	**$407,000**	**$474,000**	**$2,238,000**								**$1,407,000**	**$831,000**
Phase 3 - Long-Term																		
3A	Sunol Boulevard Sewer	Pipeline	12	5,333	LF	$1,089,000	$327,000	$381,000	$1,797,000	0.3	1.2	1,458	5,309	3,851	27.5%	72.5%	$493,000	$1,304,000
3B	Upgrade PS S-8	Pump Station	---	5.4	MGD	$1,000,000	$300,000	$350,000	$1,650,000	1.1	2.1	4,841	9,459	4,618	51.2%	48.8%	$844,000	$806,000
3C	Upgrade PS S-7	Pump Station	---	4.6	MGD	$750,000	$225,000	$263,000	$1,238,000	0.9	1.9	3,971	8,551	4,580	46.4%	53.6%	$575,000	$663,000
Phase 3 Total						**$2,839,000**	**$852,000**	**$994,000**	**$4,685,000**								**$1,912,000**	**$2,773,000**
Total						**$10,828,000**	**$3,250,000**	**$3,789,000**	**$17,867,000**								**$12,015,000**	**$5,852,000**

Notes:
(1) Construction Contingency = 30 percent of Direct Construction Cost
(2) Admin/Legal/Construction/Engineering Contingency = 35 percent of Direct Construction Cost
(3) Total Project Cost based on San Francisco ENR = 9,063 (June 2007)
(4) DUE = Dwelling Unit Equivalent = 220 gal/day

PROJECT BACKGROUND

1.1 INTRODUCTION

The City of Pleasanton (City) is located in central Alameda County east of San Francisco Bay, approximately 29 miles southeast of Oakland and 26 miles north of San Jose. The City of Dublin neighbors to the north and the City of Livermore to the east. Figure 1.1 presents a location map for the general vicinity of the City. The routes of regional significance within the City are Interstate 680, Interstate 580, Santa Rita Road, Hacienda Boulevard, Hopyard Road, Stoneridge Drive, West Las Positas Boulevard, Bernal Avenue, and Sunol Boulevard. In addition, the Bay Area Rapid Transit (BART) mass transit services the City along Interstate 580 (Figure 1.2). The City's estimated 2004 population was approximately 69,000 persons. The City occupies an area of approximately 25 square miles and conveys wastewater to a treatment plant operated by the Dublin San Ramon Services District. Effluent from the treatment plant discharges to San Francisco Bay via the regional Livermore-Amador Valley Water Management Agency (LAVWMA) pipeline.

The purpose of this study was to (1) evaluate the capacity of the existing collection system using dry and wet weather flows and (2) develop a capital improvement program that provides the City with a reliable plan to mitigate existing system deficiencies and expand the wastewater collection system to service future customers.

1.2 STUDY OVERVIEW

In accordance with the scope of work for this project, the following major tasks were completed:

Data Collection and Review - The collection system and land use data was obtained from the City's GIS database. Records of historical capacity problems and storm related overflow events were provided by City staff. In addition, the previous master plan and other specific area reports were reviewed.

Perform Temporary Flow Monitoring Program - Temporary flow monitoring was conducted from January 31 to February 29, 2004 through a separate contract with Villalobos & Associates Consulting Engineers (V&A). A total of 11 flow meters and five rain gauges were installed to measure dry and wet weather conditions. The flow monitoring and rain gauge data were analyzed to determine which rainfall event to use for hydraulic model calibration and the inflow and infiltration analysis.

Develop Flow Criteria - Existing and build-out wastewater flow estimates were based on City parcel level water consumption records for 2003 and a vacant land study.

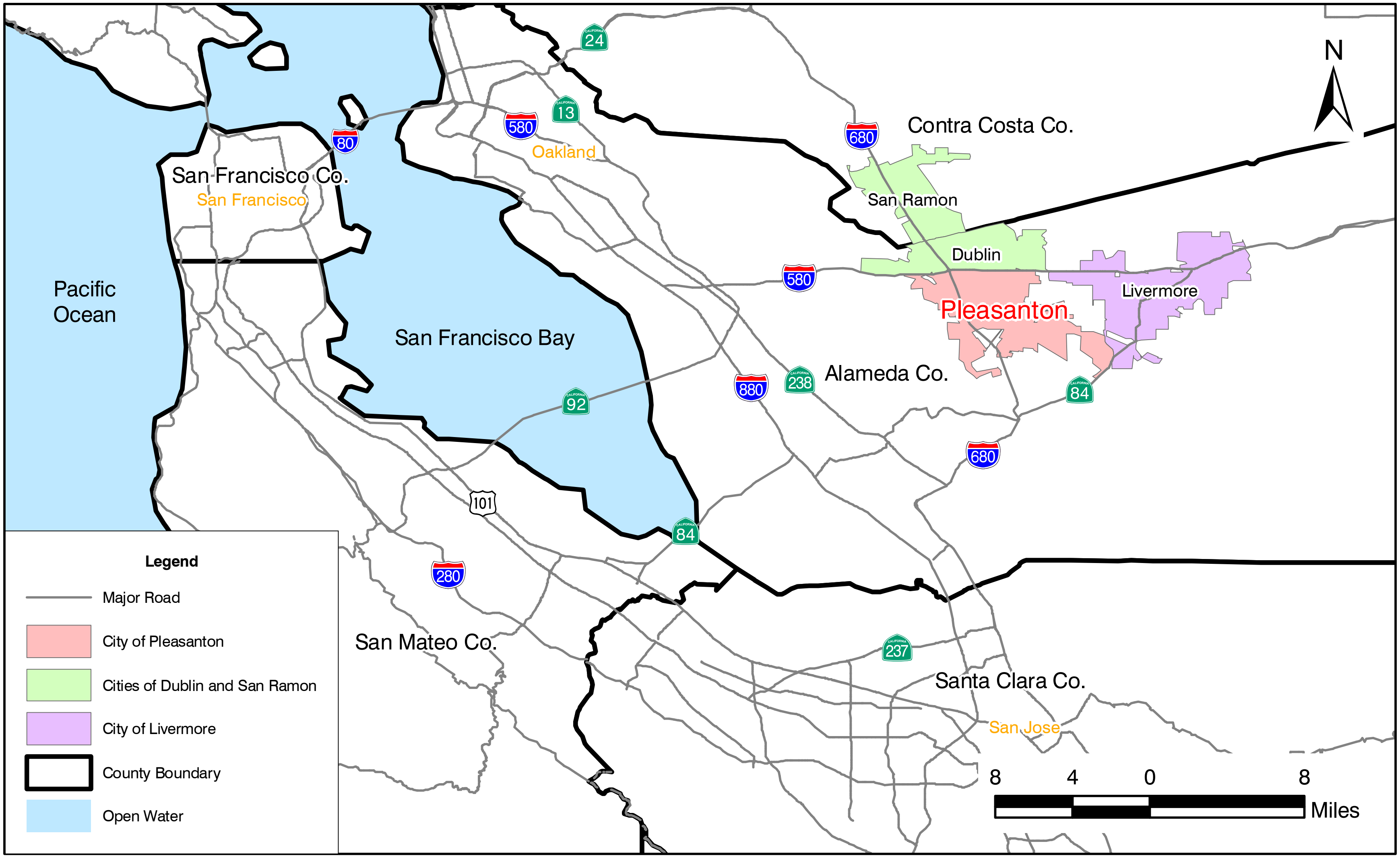

Figure 1.1
GENERAL LOCATION MAP
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

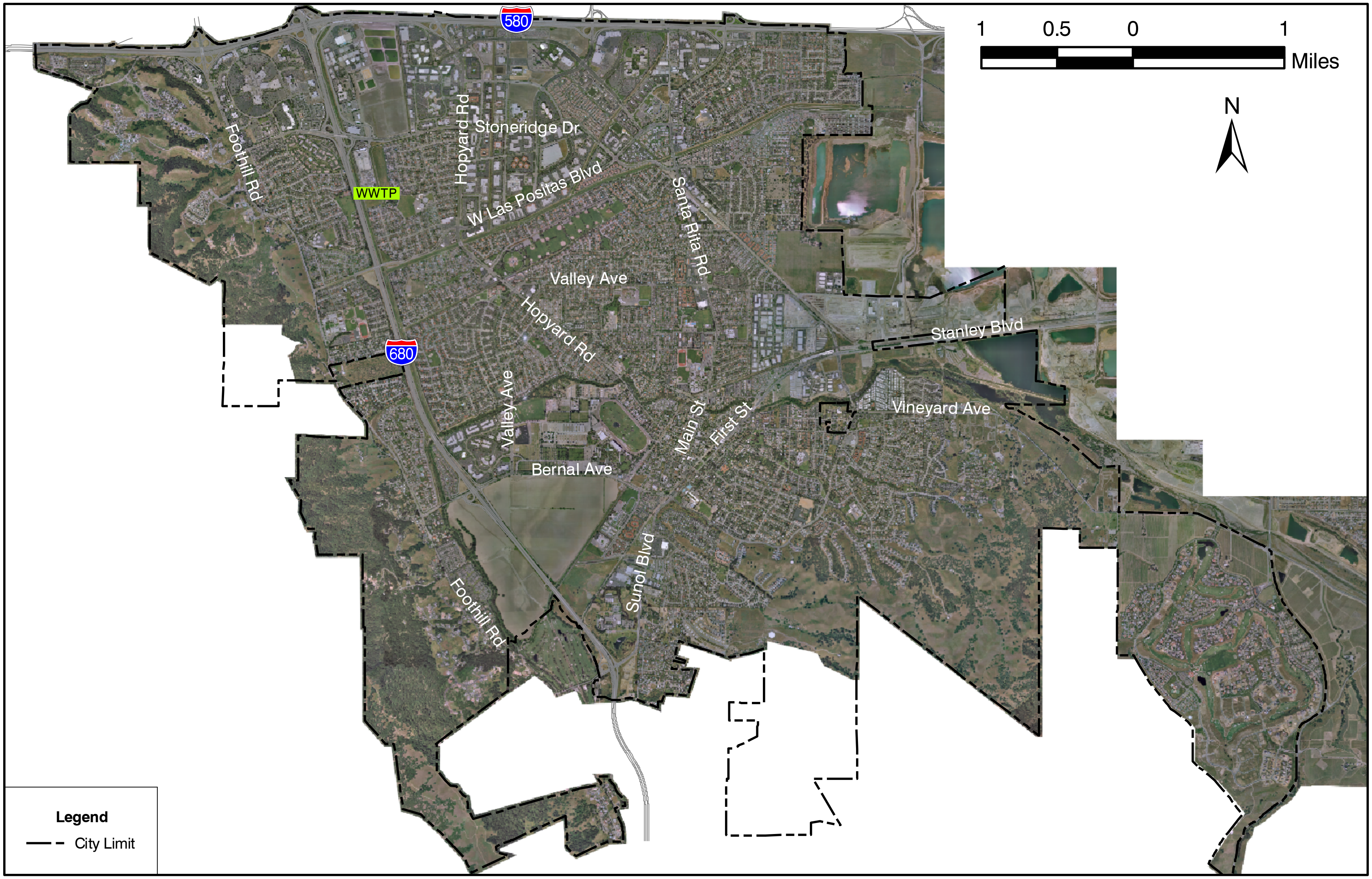

Figure 1.2
CITY AERIAL PHOTO
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

Develop Hydraulic Model - Several hydraulic model software packages were evaluated and MWH Soft, Inc.'s H2OMAP Sewer hydraulic model was selected. The hydraulic model was developed using the City's existing GIS database. In addition, information on pipelines currently in design or construction were provided by the City and incorporated into the model. The collection system model was calibrated to dry and wet weather flow data supplied by the temporary flow monitoring program.

Wet Weather Capacity - A design storm was run through the hydraulic model to develop peak wet weather flows.

Hydraulic Capacity of System - Capacity deficiencies and restrictions were identified under peak wet weather flow conditions for both existing and build-out flows. The results were placed in a table indicating pump station capacities for calculating pumping deficiencies.

Identify Future Improvements - A Capital Improvement Program (CIP) was developed which identifies necessary improvements for the next 15 years. Cost estimates and project phasing are also included.

Prepare Master Plan Report - This report serves as the project summary for the master plan update. The contents of the report are provided in the next section and summarize the work completed for the hydraulic modeling, flow estimates, and the CIP.

1.3 REPORT CONTENTS

This report contains the following chapters with a brief description of each chapter's contents.

- **Executive Summary** - Presents a brief background of the City of Pleasanton wastewater system, the need for this wastewater system master plan, and proposed improvements.
- **Chapter 1: Introduction** – Provides background information for the report and presents the scope of work involved in the master plan update.
- **Chapter 2: Planning Area Characteristics** – Provides a description of the existing and build-out land use for the City service area.
- **Chapter 3: Wastewater Flow Components** – Provides a description of flow components.
- **Chapter 4: Flow Monitoring** – Summarizes the temporary flow and rainfall monitoring effort and the inflow and infiltration analysis.

- **Chapter 5: Existing System and Hydraulic Model** – Summarizes the existing collection system facilities and the hydraulic modeling effort. This chapter includes the flow estimates, the development of the hydraulic model, and the calibration process.
- **Chapter 6: Capacity Analysis** – Discusses the development of the design storm used to assess the performance of the collection system. This chapter summarizes the results of the hydraulic model simulations during peak wet weather flows and identifies system deficiencies per the City's design criteria.
- **Chapter 7: Regulatory Issues** - Discusses existing and proposed legislation and their impact on the City.
- **Chapter 8: Capital Improvement Program** – Provides a capital improvement program, cost summary and phased list of improvements.

PLANNING AREA CHARACTERISTICS

2.1 EXISTING LAND USE

Land use data is an integral component in characterizing wastewater flows within the City. The type of land use in an area will affect the volume and character of the generated wastewater flows. The City provided existing land use data on a parcel level in GIS format. Table 2.1 presents the type and acreage of each existing land use designation within the City (Figure 2.1).

Approximately 5,665 acres (54.6 percent) of the City's sewered area is residential. Commercial area is approximately 1,626 acres (15.7 percent) of the City. Most of the City’s commercial area is located in the Hacienda Business Park area, Bernal Business Park area, downtown area, and along major transportation routes. Industrial area makes up 354 acres of the City (3.4 percent). The remaining areas of the City are designated public (including schools), park, and agriculture land uses.

2.2 FUTURE LAND USE

Build-out land use designations were determined using the City’s database for vacant/future commercial parcels and the annexed/future residential parcels database. Most of the change in land use occurs in the eastern and southern edges of the City. Table 2.1 presents the type and acreage of each land use designation for the future condition (Figure 2.2). This future land use will dictate the potential wastewater flows in the City.

The sewered area increased from an existing 10,380 acres to 15,173 acres at future conditions, an increase of approximately 46 percent. Residential land use increased from 5,665 acres to 10,223 acres, an increase of 80 percent; commercial area increased from 1,626 acres to 2,557acres, an increase of 3 percent acres; industrial area increased from 354 acres to 460 acres, an increase of 30 percent.

Table 2.1 Land Use
Wastewater System Master Plan
City of Pleasanton

Land Use Designation	Existing Area(1) (acres)	Existing Percent of Total Area	Future Area(2) (acres)	Future Percent of Total Area	Change in Area (acres)
Low Density Residential	2,406	23.2%	2,690	17.7%	+284
Medium Density Residential	2,499	24.1%	6,832	45.0%	+4,333
High Density Residential	760	7.3%	701	4.6%	-59
Commercial	1,626	15.7%	2,557	16.8%	+931
Industrial	354	3.4%	460	3.0%	+106
Public	1,298	12.5%	1,078	7.1%	-220
Park	740	7.1%	402	2.7%	-338
Rural	409	3.9%	332	2.2%	-77
Agriculture	198	1.9%	106	0.7%	-92
Quarry	85	0.8%	12	0.1%	-73
No Data	4	0.0%	4	0.0%	0
Total	**10,379**	**100.0%**	**15,174**	**100.0%**	**+4,795**

Notes:
(1) Based on land use database obtained from City Planning and GIS departments, dated December 2003 (Appendix A).
(2) Based on land use (December 2003), vacant and future residential/commercial (January 2004) databases obtained from City Planning and GIS departments (Appendix B).

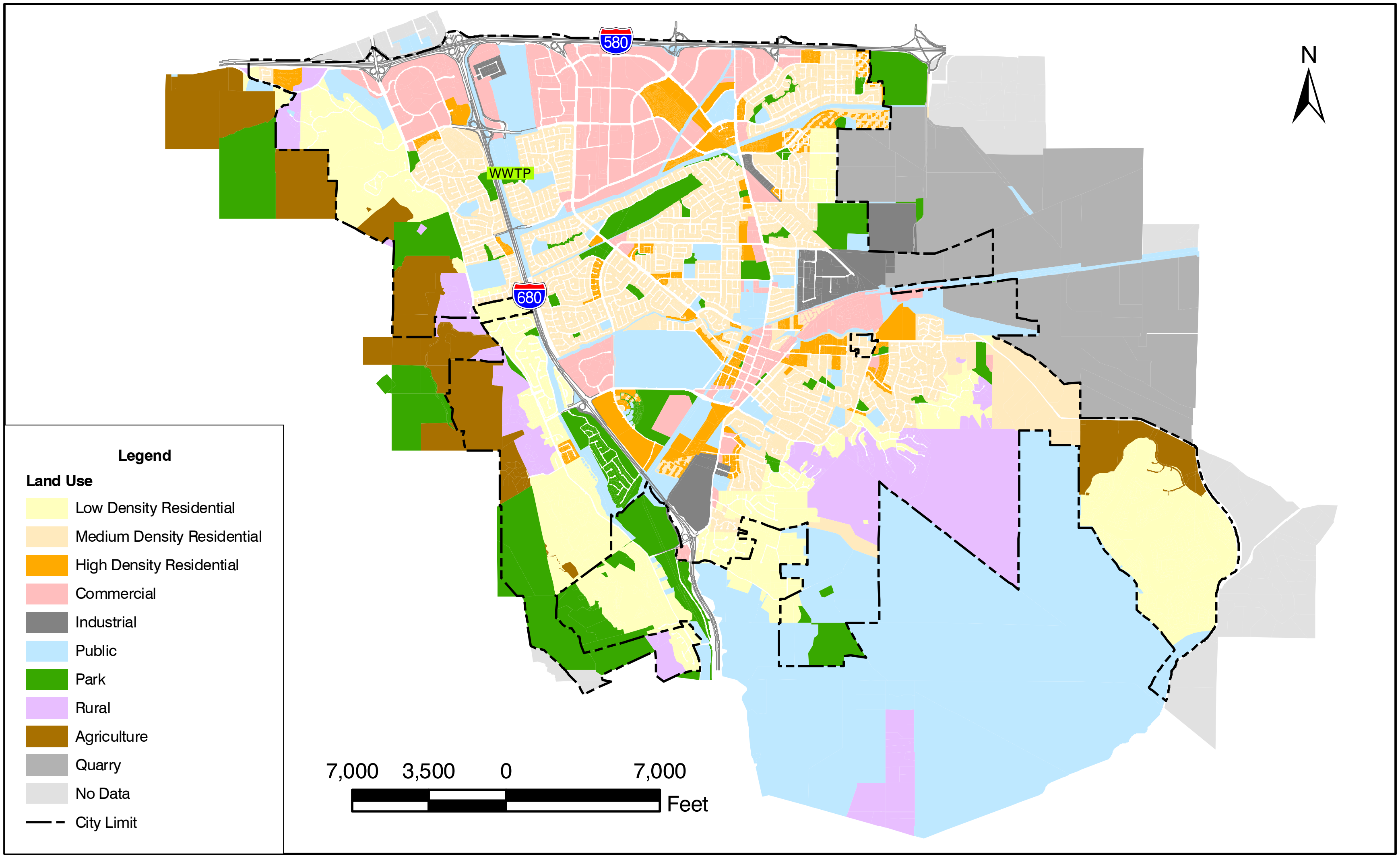

Figure 2.1
EXISTING LAND USE
WASTEWATER SYSTEM MASTER PLAN
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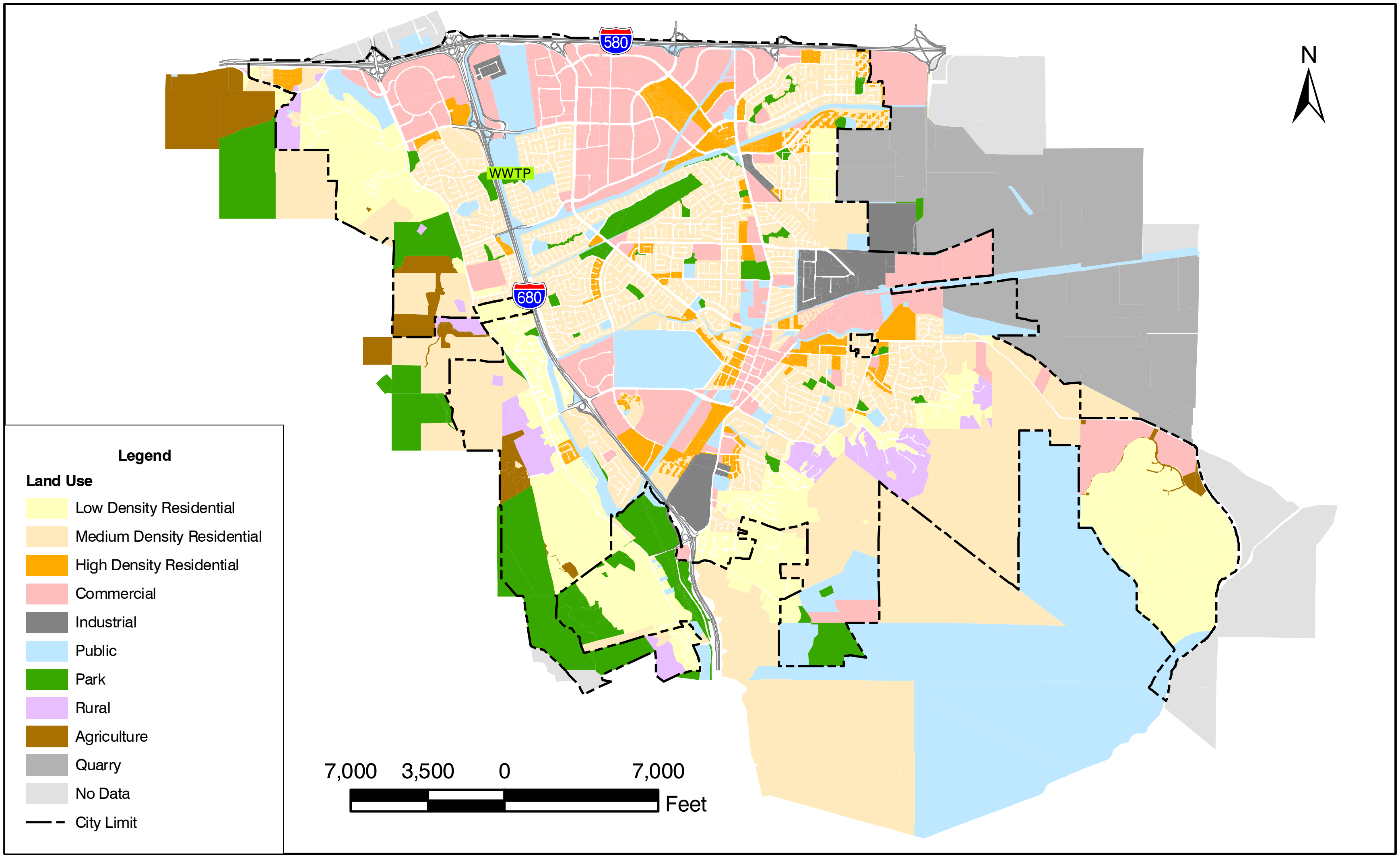

Figure 2.2
FUTURE LAND USE
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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WASTEWATER FLOW COMPONENTS

3.1 INTRODUCTION

A sanitary sewer collection system receives two flow components: dry weather flow (DWF) and wet weather flow (WWF). The dry weather flow component (or baseflow) is flow generated by routine water usage in the residential, commercial, business and industrial sectors of the City. The wet weather flow component includes baseflow, storm water inflow, and ground water infiltration. This extraneous groundwater and storm water, termed infiltration/inflow (I/I), is dependent upon groundwater levels and rainfall patterns and may enter the system through pipe and manhole defects or direct drainage connections.

Figure 3.1 illustrates the various wastewater flow components, and a description of each flow component is detailed in the following sections.

3.2 BASE WASTEWATER FLOW

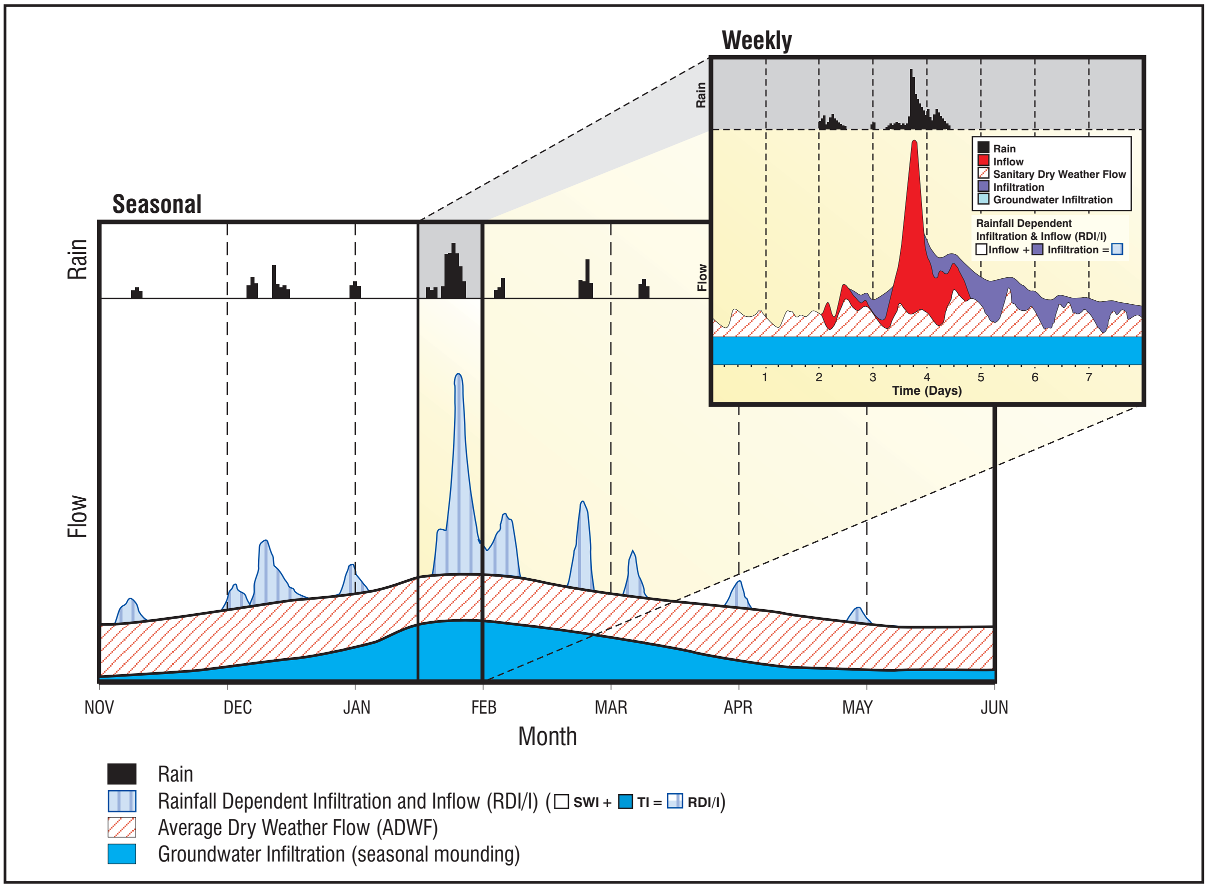
The Base Wastewater Flow (BWF) is the flow generated by the City's residential, commercial, and industrial customers. The flow has a diurnal pattern that varies with land use categories. Typically, a residential diurnal pattern has two peaks with the more pronounced peak following the wake-up hours of the day, and a less pronounced peak occurring in the evening. Commercial and industrial patterns, though they vary depending on the type of use, typically have more consistent higher flow patterns during business hours, and lower flows at night. Furthermore, the diurnal flow pattern experienced during a weekend may vary from the diurnal flow experienced during a weekday. For the purpose of hydraulically evaluating the collection system, a combined residential/commercial/industrial weekday diurnal curve will be used.

3.3 GROUNDWATER INFILTRATION

Groundwater Infiltration (GWI), one of the components of I/I, is associated with extraneous water entering the sewer system through defects in pipes and manholes. This component is related to the condition of the sewer pipes, manholes, and groundwater levels. GWI may occur throughout the year, although GWI rates are typically higher in the late winter and early spring. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques.

3.4 AVERAGE DRY WEATHER FLOW

The average dry weather flow (ADWF) is the average flow that occurs on a daily basis during the dry weather season. The ADWF includes the BWF generated by the City's residential, commercial, and industrial users, plus the dry weather GWI component.



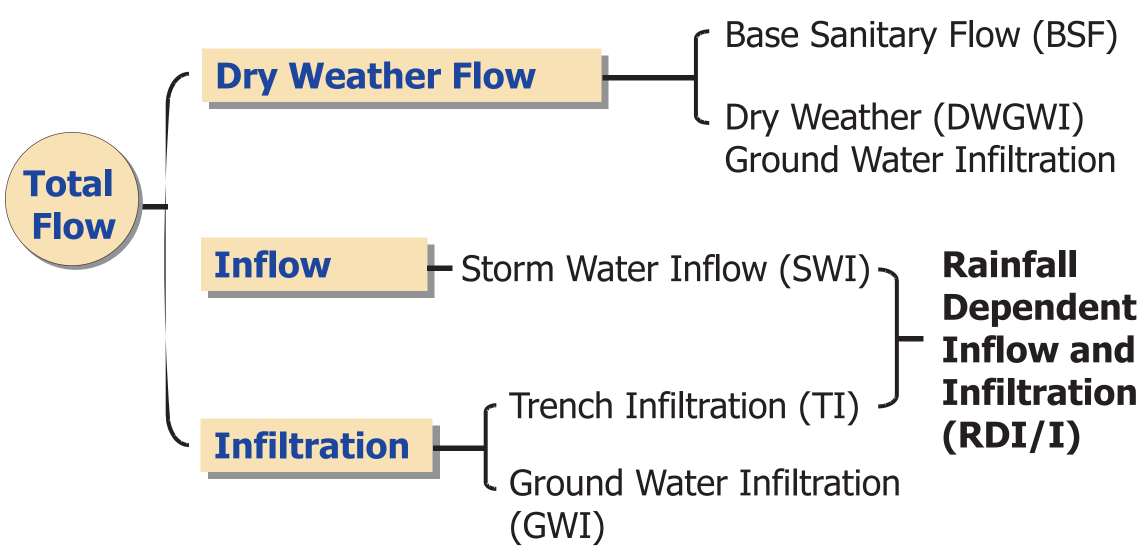


Figure 3.1
WASTEWATER FLOW COMPONENTS
CITY OF PLEASANTON

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3.5 PEAK DRY WEATHER FLOW

The peak dry weather flow (PDWF) is the highest observed hourly flow that occurs during the dry weather season. The PDWF component is typically used for designing the capacity of sewer pipes.

3.6 PEAK WET WEATHER FLOW

The peak wet weather flow (PWWF) is the highest hourly flow that occurs during the 5-year, 24-hour design storm. The peak wet weather flow component is typically used for designing the capacity of the sewer system while providing some acceptable allowance for surcharging. In this study, PWWF was used to evaluate the system's wet weather capacity. Unlike the PDWF analysis, the PWWF hydraulic analysis allows surcharging during wet weather conditions with the hydraulic grade line rising up to a foot below the manhole rim. Flows that exceed this criterion are considered to be causing a deficiency.

3.7 INFLOW AND INFILTRATION

Inflow and infiltration enters the collection system in a variety of ways. Some of the most common sources of I/I are presented in Figure 3.2. Infiltration is defined as stormwater flows that enter the collection system by percolating through the soil and then through defects in pipelines, manholes and joints. Examples of defects that allow infiltration into the collection system are cracked or broken pipes, misaligned joints, deteriorated manholes and root penetration. Inflow is defined as stormwater that enters the collection system via a direct connection to the system. A few examples of inflow are downspout connections, foundation or yard drains, leaky manhole covers and illegal storm drain connections. The adverse effects of I/I entering the collection system is that they increase both the flow volume and peak flows in the system so that it is operating at or above its capacity. Excessive I/I in the sanitary sewer collection system is the leading cause of sanitary sewer overflows (SSO's). Figure 3.3 illustrates the effects of I/I on a collection system.

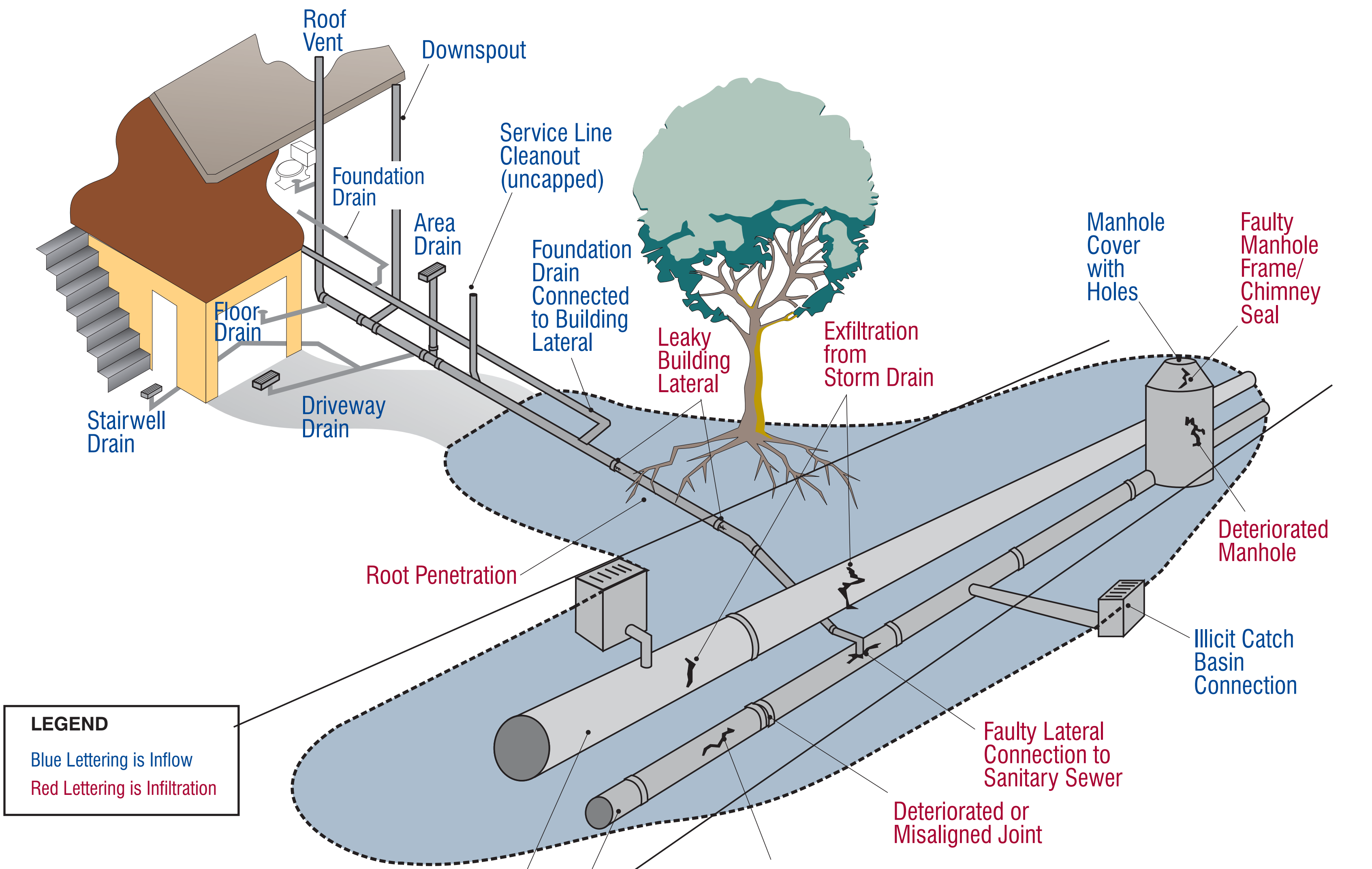

Figure 3.2
TYPICAL SOURCES OF INFILTRATION AND INFLOW
CITY OF PLEASANTON

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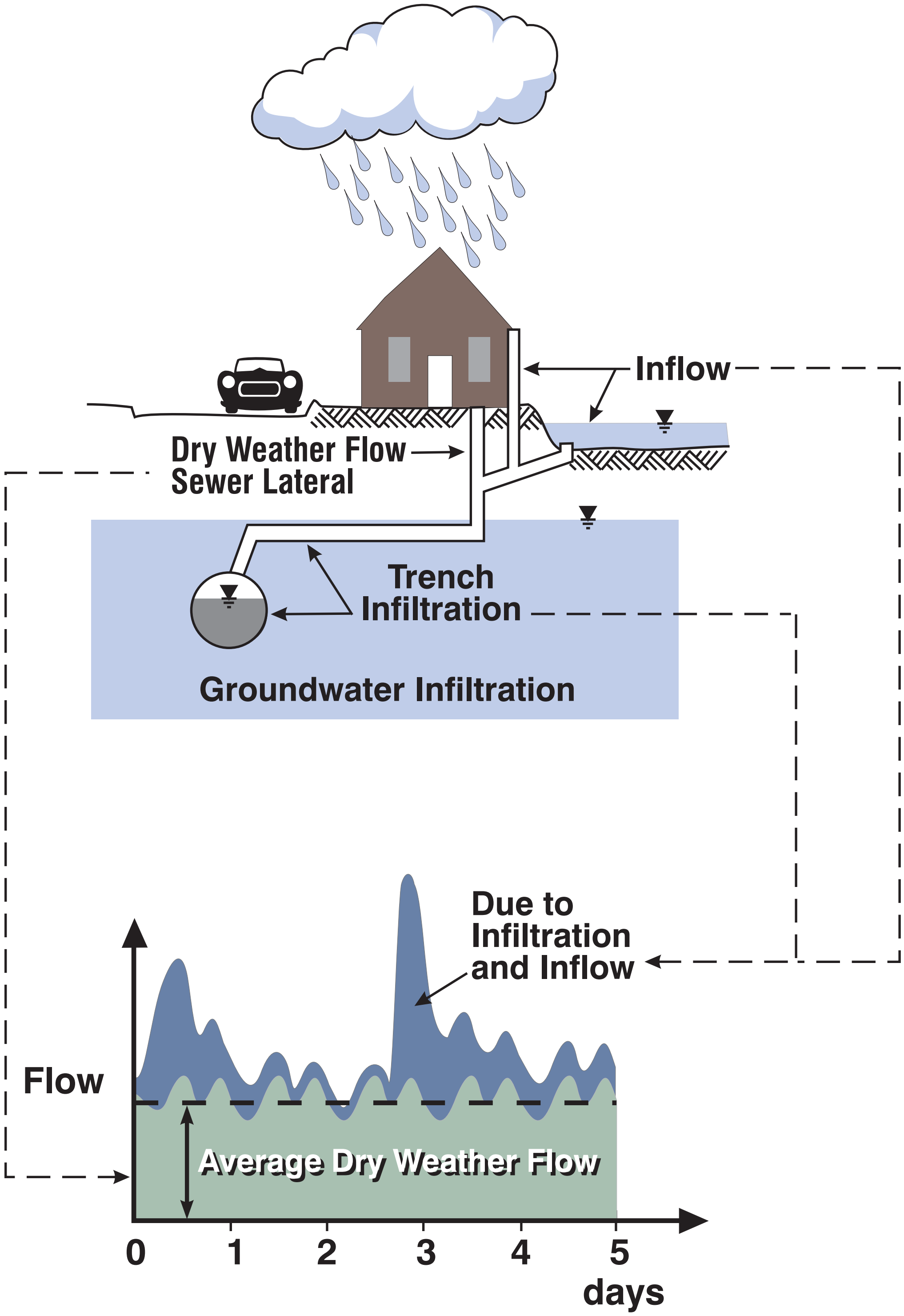

Figure 3.3
EFFECTS OF INFILTRATION AND INFLOW
CITY OF PLEASANTON

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TEMPORARY FLOW MONITORING PROGRAM

4.1 INTRODUCTION

Temporary flow meters and rain gauges were installed in order to correlate real world collection system flows with the estimated flows in the hydraulic model. The temporary flow monitoring and rain gauge data is used to calibrate the collection system hydraulic model for dry and wet weather flow, as well as perform an inflow and infiltration analysis.

Carollo Engineers, P.C., (Carollo) contracted Villalobos & Associates (V&A) Consulting Engineers for the flow monitoring effort. The report entitled "Sanitary Sewer Flow Monitoring Study," dated April 2004 presents the flow results for each temporary flow meter and rain gauge. This chapter serves to summarize the V&A flow monitoring effort. The V&A report is located in Appendix C.

4.2 FLOW MONITORING OF SEWER BASINS

Five rain gauges and 11 flow meters were used for the flow monitoring effort. Flow monitoring was conducted for 29 days during the 2003-2004 wet weather season. The temporary flow meters were installed by V&A on January 31, 2004 and removed on February 29, 2004. During flow monitoring, depth and velocity data were collected at each meter and translated into 60-minute intervals to assist the modeling effort and inflow and infiltration analysis.

The City service area was divided into unique sewer basins based on the topographical layout of the sewer system and the location of major sewer pump stations. The temporary flow meters were installed at the terminus of each sewer basin to measure dry and wet weather flow from each sewer basin. Figure 4.1 presents the flow monitoring and rain gauge locations as well as the sewer basin layout for the City.

Each unique sewer basin is defined by a combination of flow meters, which measure the wastewater flowing in and out of the basin. A simplified schematic illustrating the direction of flow and connection between the basins is presented in Figure 4.2.

4.3 RAINFALL MONITORING

Three rain gauges were installed by V&A during the temporary flow monitoring effort at various locations around the City to capture the typical Bay Area rainy season of mid-January through March. In addition, rainfall data from two existing rain gauges were also utilized, making a total of five gauges used. The locations of these five rain gauges in relation to the City service area are presented in Figure 4.1

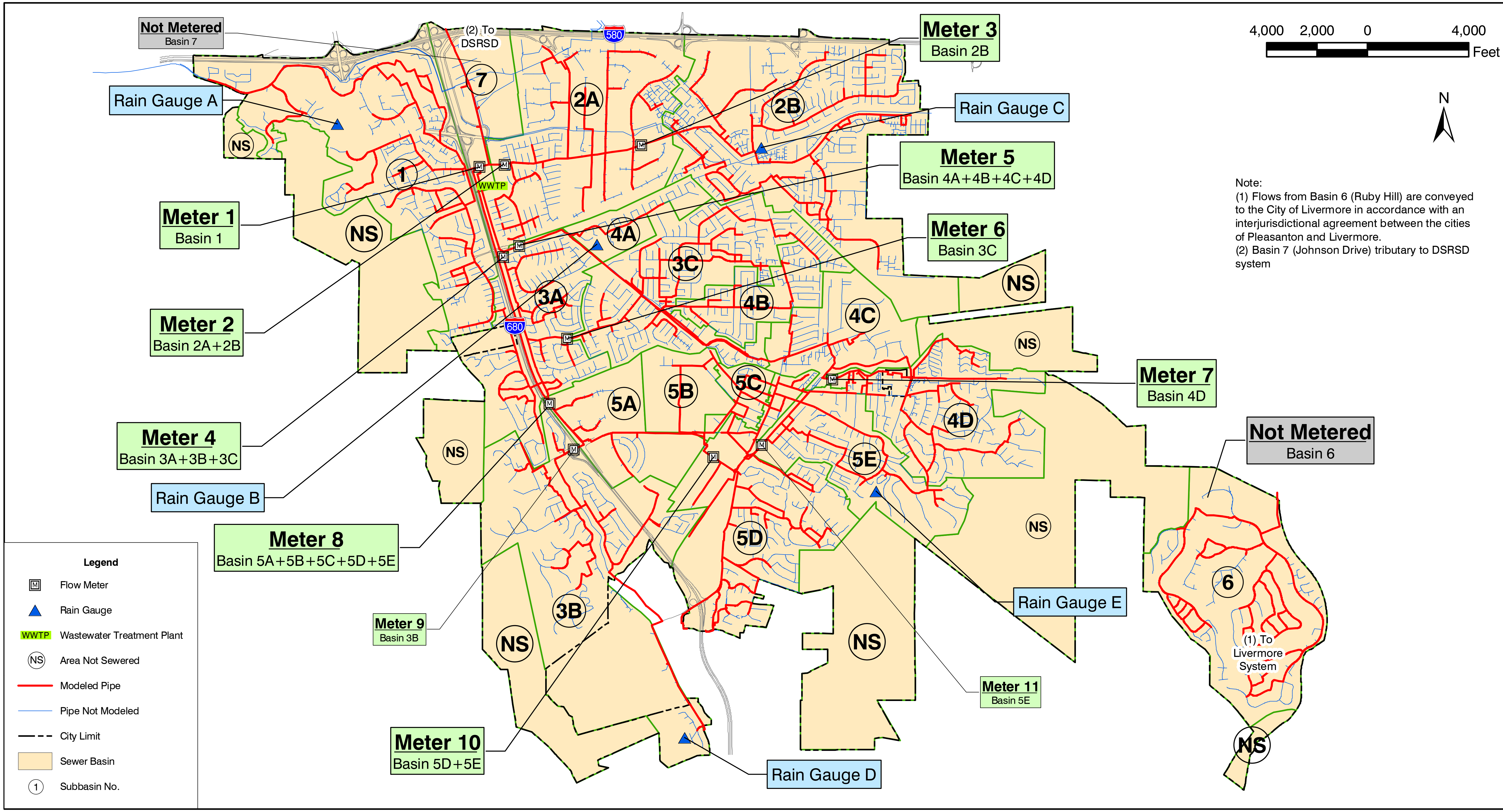

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Figure 4.1
FLOW METER AND RAIN GAUGE LOCATIONS
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

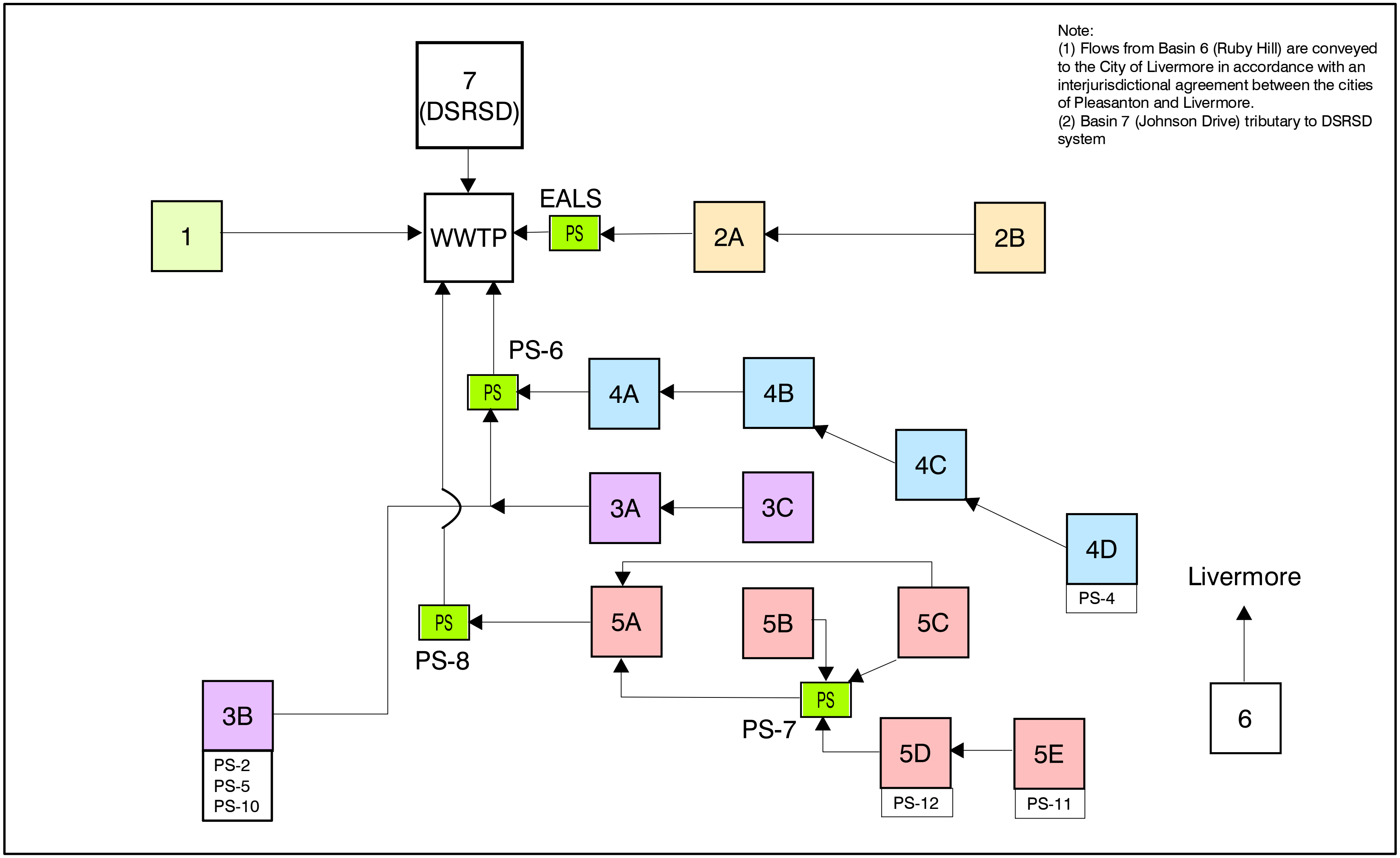

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Figure 4.2
BASIN FLOW SCHEMATIC
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

Three significant rainfall events occurred during the monitoring period in February 2004. A summary of the three rainfall events captured during the flow-monitoring period is presented in Table 4.1. Rain Gauge B is centrally located within the City and is generally indicative of the amount of rainfall through most of the developed area. Rain Gauge B measured 1.36 inches for Event No. 1, 0.77 inches for Event No. 2 and, and 0.99 inches for Event No. 3.

Table 4.1 Rainfall Events
Wastewater System Master Plan
City of Pleasanton

Event No.	Event Period	Event Description	Estimated Soil Condition	Rain Gauge A (inch)	Rain Gauge B (inch)	Rain Gauge C (inch)	Rain Gauge D (inch)	Rain Gauge E (inch)
1	**24 Hours** 2/2/04 9:00 a.m. to 2/3/04 8:00 a.m.	Strong 2-hour high intensity rainfall followed by light intensity rainfall	Lightly saturated: Sparse rainfall since 1/1/04	1.34	1.36	1.36	1.38	1.42
2	**18 Hours** 2/17/04 4:00 p.m. to 2/18/04 9:00 a.m.	Moderate and consistent intensity rainfall for 18 hours	Lightly saturated	1.25	0.77	0.53	1.28	1.18
3	**46 Hours** 2/25/04 6:00 a.m. to 2/27/04 4:00 a.m.	Intermittent short duration bursts between light intensity rainfall	Moderately saturated	2.45	0.99	1.06	1.92	1.63

For the purpose of the hydraulic modeling task Event No. 2 was used for calibration, while Event No. 3 was used for verification. Event No. 2 exhibited moderate and consistent intensity rainfall over a 18-hour period and is considered most appropriate for the calibration effort because of these characteristics. The other rainfall events were characterized with intermittent intensities.

Event No. 3, which has intermittent short duration bursts and coincided with moderately saturated soils, was used to verify the hydraulic model calibration.

4.4 DRY AND WET WEATHER FLOW RESULTS

Flow monitoring results are provided for each flow meter as well as each sewer basin. Each meter was placed in a strategic location that ensured that flow from the basins could be accurately calculated. Depending on the location of the particular meter, it measures flow from portions of, or multiple, sewer basins. The flow attributed to each basin is calculated using a combination of flow meters. A summary of the flow-monitoring program, for both dry and wet weather, is presented in Table 4.2, listed by meter. Table 4.3 summarizes the flow-monitoring program by basin. A characteristic dry weather period was chosen from the available 29 days of flow data to perform the DWF calibration. The flow monitoring data for the days of February 4, 5, 9-13, 2004 provided the most characteristic DWF period because they did not include rainfall. The hourly data for the seven days were averaged to provide a typical 24-hour DWF pattern at each meter. This hourly flow data was then used to calibrate the hydraulic model for DWF.

Table 4.2 Flow Monitoring Program
Wastewater System Master Plan
City of Pleasanton

			Dry Weather Flow			Wet Weather Flow		
Meter I.D.	Manhole I.D.	Pipe Diameter (inches)	Average DWF(1) (mgd)	Minimum DWF (mgd)	Maximum DWF (mgd)	PWWF(2) (mgd)	Flow Depth at PWWF (inches)	d/D(3)
M1	SB3A1M408	24	0.68	0.24	1.17	2.64	>24.00	1.00
M2	SB3A2M301	27	1.56	0.58	2.58	6.73	>27.00	1.00
M3	SC2C3M503	24.75	0.85	0.18	1.65	2.91	9.54	0.39
M4	SB4A2M400	22	1.11	0.35	2.28	3.44	12.08	0.55
M5	SB3C4M401	30	0.95	0.35	1.81	3.55	24.68	0.82
M6	SB4D3M307	18	0.63	0.19	1.15	1.38	12.17	0.68
M7	SD5A4M109	15	0.49	0.14	1.00	1.32	7.78	0.52
M8	SB5D1M201	27	1.02	0.39	1.71	2.51	9.06	0.34
M9	SB5D4M400	18	0.23	0.09	0.40	0.75	7.78	0.43
M10	SC6B1M101	24	0.94	0.43	1.57	2.16	6.04	0.25
M11	SC5D4M402	15	0.41	0.21	0.76	1.08	5.86	0.39

Notes:
(1) DWF = dry weather flow
(2) PWWF = peak wet weather flow (hourly)
(3) d/D = flow depth to pipe diameter ratio

Table 4.3	Flow Monitoring by Basin Wastewater System Master Plan City of Pleasanton			
Basin	**ADWF (mgd)**	**Minimum DWF (mgd)**	**Maximum DWF (mgd)**	**PWWF (mgd)**
1	0.68	0.24	1.17	2.64
2A	0.71	0.26	1.17	3.06
2B	0.85	0.18	1.65	2.91
3A	0.25	0.08	0.51	0.77
4A, 4B, & 4C	0.46	0.17	0.88	1.72
3C	0.63	0.19	1.15	1.38
4D	0.49	0.14	1.00	1.32
5A, 5B, & 5C	0.08	0.03	0.13	0.20
3B	0.23	0.09	0.40	0.75
5D	0.53	0.24	0.89	1.22
5E	0.41	0.21	0.76	1.08
Total	**5.32**	**1.84**	**9.71**	**17.05**

Flow monitoring data was also evaluated to determine the optimal wet weather period to calibrate the hydraulic model. The PWWF at each of the 11 temporary flow meters occurred during the February 17 through 18, 2004 rainfall event. The February 17 through 18, 2004, rainfall event occurred in the middle of the flow monitoring period and was preceded by two events of significant size and thus provided optimal antecedent soil moisture conditions upon which to calibrate the hydraulic model.

During the wet weather flow-monitoring period, two of the 11 flow meters were at full pipe. The flow monitoring locations that were at full capacity during the calibration storm event are Flow Meters 1 and 2, representing Basins 1 and 2A, respectively. The remaining flow monitoring locations were less than 75 percent full during the calibration storm.

4.5 INFLOW AND INFILTRATION ANALYSIS

There are numerous methods to quantify rainfall dependent infiltration. The initial methods used, based only on analysis of flow data, the R-Value method and the peaking factor method. The R-Value method is defined as the volume of infiltration and inflow for the storm event divided by the total volume of rainfall over a basin and is calculated by the following equation:

R-Value Equation: $R = (I/I) / [A * Rain]$

Where:
- I/I = Volume of infiltration and inflow, ft^3
- A = Area of basin, ft^2
- Rain = Depth of rainfall, ft.

The calculated R-Values are specific to the storm event being quantified and thus different storm events will yield different values. A collection system with R-Values less than 5 percent are generally considered to have acceptable inflow and infiltration.

The inflow component of RDII is measured using peaking factors. Peaking factors define the extent of peak flows in the collection system. The peaking factor method is defined as the hourly PWWF divided by the average dry weather flow. A peaking factor of three is typically used in the design of new sewers. A peaking factor greater than five usually indicates potential inflows into the sewer system. Table 4.5 summarizes the inflow and infiltration methods used to assess the performance of the City's collection system for the three rainfall events.

Results from the inflow and infiltration analysis show that the majority of the collection system facilities are displaying few deficiencies. R-Values and peaking factors include both infiltration and inflow; however, R-Values tend to better express the severity of infiltration while peaking factors express the severity of inflow. All basins are well below the R-value threshold of 5 percent, thus showing few effects of infiltration. The corresponding factors in most basins were below the threshold of three. Table 4.5 indicates that the basin peaking factors are generally around three, except for Basin 3A and Basin 5A+5B+5C.

The high peaking factor for Basin 3A may be attributed to its location in a hilly area with significant tributary open space and permeable basins. The unusually high peaking factor for Basin 5A+5B+5C may be attributed to the low dry weather flows where a small spike in wet weather flow can significantly increase peaking factors. Further studies in these areas can be used to determine the validity of these anomalous peaking factors.

This initial I/I analysis was performed by analyzing flow data (not modeling), and is only an indicator of potential basin level I/I problems. Detailed hydraulic modeling, included in the next chapter, expands on this initial analysis and identifies potential capacity deficiencies on the project level.

Table 4.5 Inflow and Infiltration Analysis
Wastewater System Master Plan
City of Pleasanton

Basin I.D.	ADWF[4] (mgd)[8]	Event No. 1[1] PWWF[5] (mgd)	Event No. 1[1] PF[6]	Event No. 1[1] R-Value[7] (%)	Event No. 2[2] PWWF[5] (mgd)	Event No. 2[2] PF[6]	Event No. 2[2] R-Value (%)	Event No. 3[3] PWWF[5] (mgd)	Event No. 3[3] PF[6]	Event No. 3[3] R-Value (%)
1	0.68	1.09	1.6	0.1%	1.25	1.8	0.3%	2.45	3.6	1.2%
2A	0.71	2.59	3.7	0.1%	1.34	1.9	0.4%	3.29	4.6	0.0%
2B	0.85	2.16	2.5	0.8%	2.74	3.2	2.7%	2.83	3.3	3.6%
3A	0.25	2.32	9.3[9]	0.9%	1.60	6.4	0.9%	3.44	13.7[9]	3.2%
3B	0.23	0.47	2.0	0.1%	0.57	2.5	0.2%	0.74	3.2	0.4%
3C	0.63	1.13	1.8	0.1%	1.12	1.8	0.2%	1.15	1.8	0.3%
4A+4B+4C	0.46	1.47	3.2	0.0%	0.91	2.0	0.0%	1.60	3.5	0.0%
4D	0.49	1.06	2.2	0.7%	1.14	2.3	0.8%	1.28	2.6	1.6%
5A+5B+5C	0.08	2.09	26.1[9]	0.3%	0.59	7.3	0.3%	2.49	31.1[9]	0.5%
5D	0.53	1.59	3.0	0.6%	1.23	2.3	1.3%	2.07	3.9	1.1%
5E	0.41	0.67	1.6	0.0%	0.69	1.7	0.3%	1.00	2.4	2.4%

Notes:
(1) Event No. 1 occurred over a 24 hour period from February 2-3, 2004.
(2) Event No. 2 occurred over an 18 hour period from February 17-18, 2004.
(3) Event No. 3 occurred over a 46 hour period from February 25-27, 2004.
(4) ADWF = Average Dry Weather Flow.
(5) PWWF = Peak Wet Weather Flow (hourly).
(6) PF = Peaking Factor = PWWF/ADWF.
(7) R-Value is the percentage of rainfall that permeates into the sewer system.
(8) mgd = millions gallons per day.
(9) The flow-monitoring program recorded relatively high wet weather flows at these sites, with a corresponding high wet weather peaking factor.

COLLECTION SYSTEM MODELING

5.1 INTRODUCTION

A collection system model is a simplified representation of the real collection system. In general, collection system models can assess the current level of performance for the collection system based on population and land use. Also, collection system models can perform “what if” scenarios to project the performance of future developments, population and/or land use changes, and various wet weather conditions. This chapter details the collection system model used for this study.

5.2 COLLECTION SYSTEM FACILITIES

The City’s collection system serves the City and some additional areas outside the city limits. The collection system consists of approximately 6,500 manholes and 270 miles of public sewer, most of which is less than 30 years old. The City area is relatively flat and low in elevation with the exception of the hills in the western and southern portions. GWI does not appear to be a significant source of flow into the collection system.

The City of Pleasanton’s (City) wastewater is treated at the Dublin-San Ramon Services District (DSRSD) wastewater treatment plant (WWTP). The WWTP is located at Interstate 680 and Stoneridge Drive in Pleasanton. Figure 5.1 presents an overview of the City’s collection system facilities.

5.2.1 Pipelines

The collection system pipe diameters range from 4-inches to 36-inches. The larger interceptors range in diameter from 18-inches to 36-inches and they are the major pipes tributary to the WWTP. Vitrified clay pipe (VCP) comprises approximately 66 percent of the pipes. PVC pipe accounts for an additional 26 percent of the pipes in the system. The City has four major trunk mains that are tributary to the WWTP and are described below.

5.2.1.1 Highland Oaks Trunk Sewer

The Highland Oaks Trunk Sewer services the northwest portion of the City, west of Interstate 680 (Basin 1). The trunk sewer begins at Interstate 680 near Maywood Drive with a 24-inch pipe under the freeway. The trunk continues with dual 10-inch and 14-inch siphons that cross the Alamo Canal. A 24-inch pipe conveys the wastewater to the WWTP after crossing the canal.

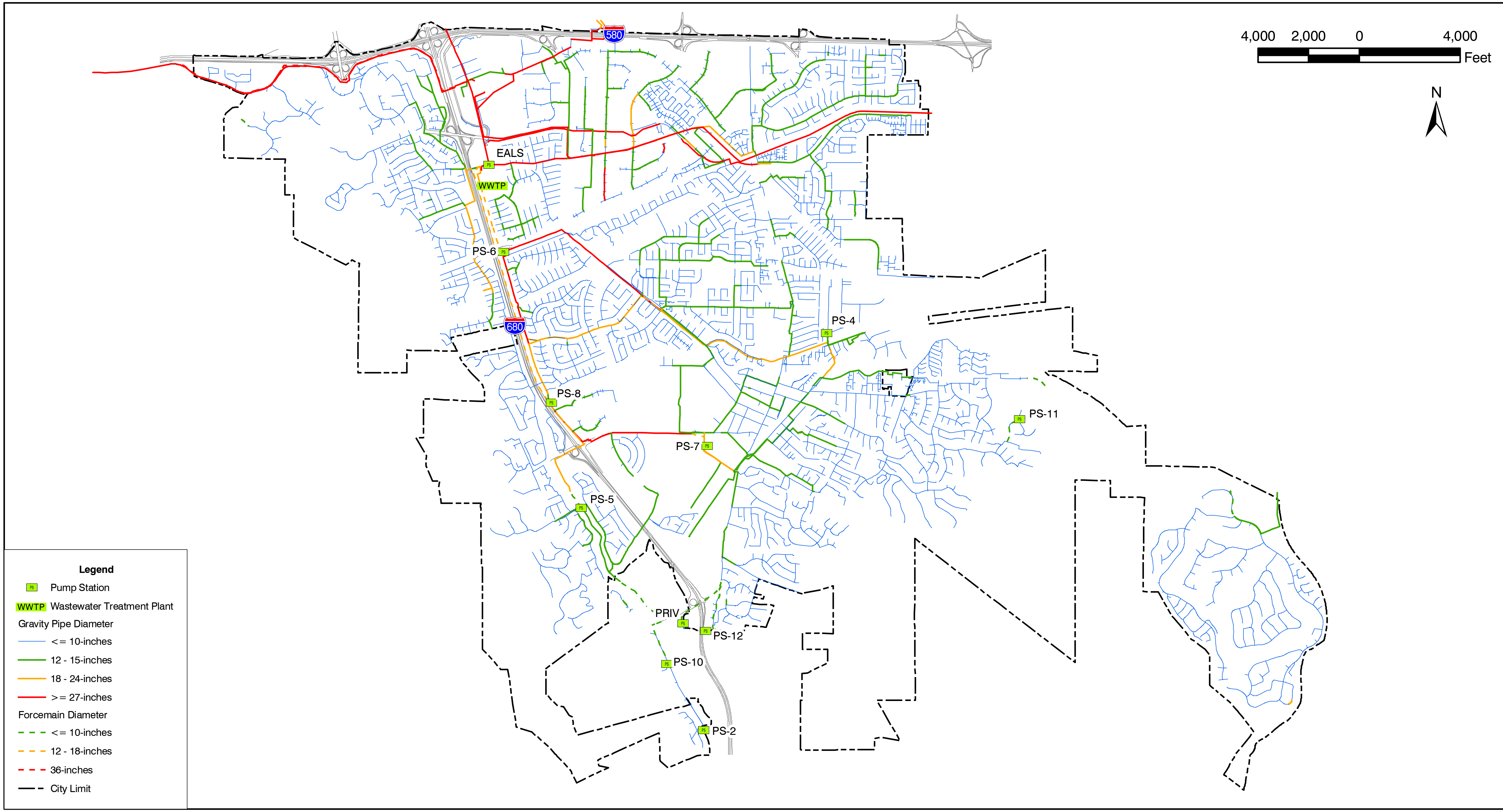

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Figure 5.1
COLLECTION SYSTEM FACILITIES
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

5.2.1.2 East Amador Trunk Sewer (EATS)

The East Amador Trunk Sewer (EATS) serves the north and northeastern portions of the City (Basin 2). The trunk sewer ranges in diameter from 24-inches at its inception at Stoneridge Drive to 30-inches at its terminus at the East Amador Pump Station on Inglewood Drive.

5.2.1.3 Pump Station S-6 Forcemain

The Pump Station S-6 (PS-6) forcemain serves the central, southwestern, and eastern portions of the City (Basins 3 and 4). The 16-inch forcemain begins at PS-6 and parallels the Alamo Canal until its terminus just outside the WWTP.

5.2.1.4 Pump Station S-8 Forcemain

The Pump Station S-8 (PS-8) forcemain serves the southern portions of the City (Basin 5). The 18-inch forcemain begins at PS-8 and parallels the Alamo Canal until its terminus just outside the WWTP.

In addition to the four pipelines that convey wastewater to the WWTP, the City has two other pipelines of significance.

5.2.1.5 East Amador Relief Sewer (EARS)

The East Amador Relief Sewer (EARS) is a currently inactive sewer that parallels the EATS sewer along Stoneridge Drive. The EARS line is a 30- to 36-inch diameter pipe that begins near the intersection of Santa Rita Road and Stoneridge Drive and ends at the intersection of Johnson Drive and Stoneridge Drive.

5.2.1.6 Cross-Town Interceptor

The Cross-Town Interceptor was constructed in 1992 as a means to reroute flow in the eastern portion on the City. Previously, wastewater was pumped through several pump stations to Basin 5. The Cross-Town Interceptor eliminated several pump stations and allowed Basin 4 to flow by gravity where it is pumped at the Pump Station S-6. The Cross Town Interceptor begins as a 24-inch diameter pipeline near the intersection of Stanley Boulevard and First Street. It continues along Trenton Circle, the Union Pacific Railroad tracks, Del Valle Parkway, Hopyard Road and ends as 30-inch pipeline at the Arroya Mocho canal.

5.2.2 Pump Stations

The City currently operates and maintains ten wastewater pump stations, nine of which were incorporated into the collection system hydraulic model. The four largest pump stations are Pump Stations S-6, S-7, S-8, and the East Amador Lift Station. Figure 5.1 presents the location of the pump stations as well as highlights their associated force mains. Table 5.1 summarizes the existing pump stations and their capacities.

Table 5.1 Pump Stations Wastewater System Master Plan City of Pleasanton			
Pump Station I.D.	**Description**	**Firm Capacity(1) (mgd)**	**Total Capacity (mgd)**
PS-2	Oak Tree Farms	0.19	0.38
PS-4	Valley Business Park	0.55	1.1
PS-5	San Francisco	2.1	3.2
PS-6	Arroyo Mocho	3.9	5.9
PS-7	Bernal	4.0	6.1
PS-8	Bernal Business Park	4.0	6.1
PS-10	Castlewood	0.35	0.69
PS-11	Gray Fox	0.07	0.14
PS-12	Sunol	0.55	1.1
EALS	East Amador Lift Station	3.6	7.2

Note:
(1) Firm capacity assumes the largest pump is out of service.

5.2.2.1 Pump Station S-6

Pump Station S-6 is an older pump station located on the southeast corner at the confluence of the Arroyo Mocho and Alamo Canals. The pump station serves Basins 3 and 4. The collected wastewater is conveyed approximately 2,700 feet via a 16-inch diameter forcemain to a 21-inch diameter gravity pipe just outside the WWTP. The pump station consists of three Pacific Pumping Co. pumps, each with a 1,400 gpm capacity. The total capacity of pump station is 5.9 million gallon per day (mgd), and the firm capacity is 3.9 mgd.

5.2.2.2 Pump Station S-7

Pump Station S-7 is a newer pump station located on the southwest of Bernal Avenue and the Union Pacific Railroad tracks intersection. The pump station serves Basins 5D and 5E and portions of Basins 5B and 5C. The collected wastewater is conveyed approximately 875 feet via an 18-inch diameter forcemain to a 27-inch diameter gravity pipe along Bernal Avenue.

The pump station consists of three 1,400 gpm Fairbanks Morse Colt Industries pumps. The total capacity of the pump station is 6.1 mgd, while the firm capacity is approximately 4.0 mgd.

5.2.2.3 Pump Station S-8

Pump Station S-8 is a newer pump station located behind the Koll Center business park along Interstate 680. The pump station serves Basin 5 including flow from Pump Station S-7. The collected wastewater is conveyed approximately 10,000 feet along Alamo Canal via an 18-inch diameter forcemain to the WWTP.

The pump station consists of three 1,400 gpm Fairbanks Morse Colt Industries pumps. The total capacity of the pump station is 6.1 mgd, while the firm capacity is 4.0 mgd.

5.2.2.4 East Amador Lift Station (EALS)

The East Amador Lift Station (EALS) is located within the WWTP property. The lift station services all of Basin 2 and pumps wastewater to a combined DSRSD/City influent pipeline.

The pump station consists of three pumps, two large and one small. According to DSRSD's consultant, Whitley, Burchett and Associates, the small pump is not used. The two large pumps each have a 2,500 gpm capacity. The total capacity of the pump station is 7.2 mgd, while the firm capacity is 3.6 mgd.

5.3 HYDRAULIC MODEL SELECTION

There are several hydraulic modeling software packages on the market. In collaboration with the City, a hydraulic model was selected in order to meet the City's long-term needs. During the selection process, Carollo evaluated three hydraulic model software packages based on the following criteria:

- Providing a quality calibration of the sewer basins.
- Ability to accurately model lift stations.
- Ability to accurately model diversion manholes.
- Geographical Information Systems (GIS) interface capabilities.
- Be an established, time-tested software with excellent technical support.
- Be a user-friendly software for City staff to minimize difficulty in model turnover at the completion of the project.
- Cost (both acquisition and maintenance fees).

With assistance from the City, a recommendation was made to select MWH Soft's H2OMAP Sewer Model for the collection system master plan. The H2OMAP Sewer model routes flows through the collection system in order to examine the capacity of existing pipes and show where flow restrictions occur. The H2OMAP Sewer software performs this routing technique through use of the Muskingum-Cunge explicit diffusive wave method. The diffusive wave method is a simplified version of the Saint Venant, one-dimensional equations of fluid flow. H2OMAP Sewer provides multiple wet weather flow generation techniques. The tri-triangle synthetic unit hydrograph method was chosen. A detailed description of this method is provided in the next chapter. The H2OMAP Sewer model provides seamless database and GIS interfacing of facility data, simulation results, and background GIS layers. Details of the hydraulic model software evaluation are documented in the Software Evaluation memorandum, dated December 2003 in Appendix D.

5.4 HYDRAULIC MODEL DEVELOPMENT

The H2OMAP Sewer model was developed based on the City's GIS database and additional input from City staff. The collection system data was imported directly into the model in GIS format. The collection system model includes pipes with a diameter of 10-inches or greater, and all associated manholes, diversion structures and lift stations. In some instances, 6-inch and 8-inch diameter pipes were included in the model to further define a specific area of interest. Inclusion of 10-inch and greater diameter pipes serves the purpose of minimizing model analysis run time while retaining the hydraulic integrity of the collection system. It was assumed that all pipes 8-inches in diameter and below have the capacity to service local areas.

The data from the GIS database was input into the H2OMAP Sewer hydraulic model and included pipe length, diameter, invert elevations, and rim elevations. Slopes in the hydraulic model were calculated based on invert elevations and pipe length. Where rim elevations were unknown in the collection system, they were interpolated using United States Geological Survey (USGS) Digital Elevation Model (DEM) data. Using GIS, the manholes with missing rim elevations and DEM were intersected and the corresponding elevation transferred to the manholes. Missing invert elevations were resolved by assuming a constant slope upstream and downstream of the invert in question. An additional survey task was included after elevation discrepancies were observed. This was believed to be attributed to different vertical elevation datums in the data. The survey data was used to verify the elevation data and model data was adjusted accordingly. Appendix E contains the survey data from this task. A Mannings "n" value of 0.013 was used for all pipes, based on a typical roughness value for vitrified clay pipe.

The model also includes pump stations which are defined by the appropriate parameters to describe the physical as well as operational characteristics. A pump station is defined in the model based on the maximum pump discharge capacity, pump discharge elevation, pump on and off volumes, wet well volume, force main invert elevation, and whether a pump operates as a variable or a constant speed pump. City staff provided this necessary data for pump station operation.

Figure 5.2 illustrates the City's modeled collection system. The ranges of pipe diameters in the modeled collection system are highlighted as well as the location of the pump stations.

5.5 DRY WEATHER FLOW LOADING

In order to be consistent with techniques used in the City's Water Master Plan, water billing records were used as the basis for developing the quantity of baseflow generated within the City. Land use, as previously discussed in Chapter 2, was used as a secondary component in generating baseflow for future developments. The accurate estimation of the quantity of wastewater is an important process in maintaining and sizing collection system facilities,

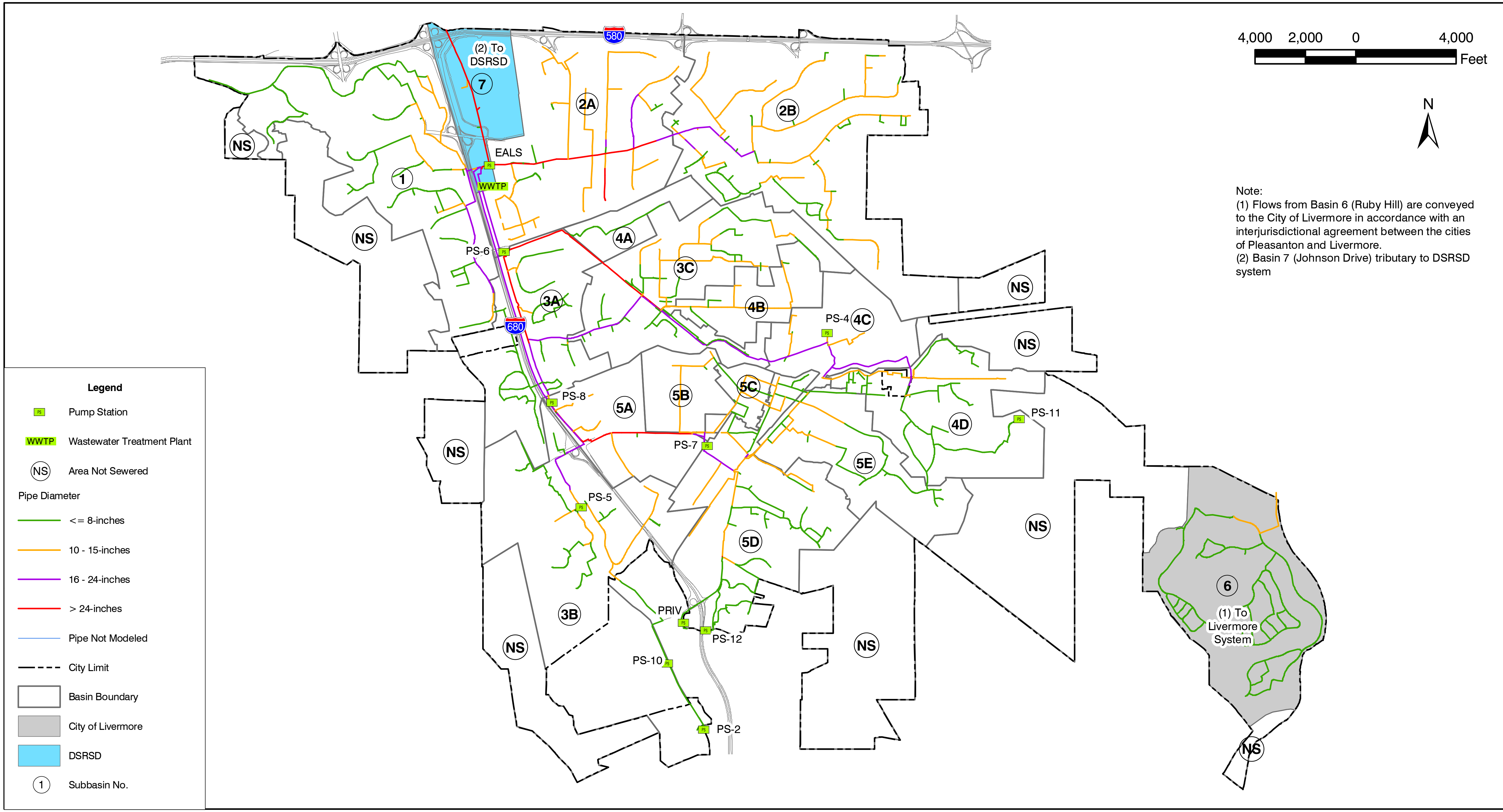

Figure 5.2
MODELED COLLECTION SYSTEM
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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January 30, 2005

both for existing conditions and future developments. The estimation of DWF is necessary to calibrate existing, and project future DWF.

Water usage billings are recorded at a parcel level. To input the baseflow into the model, each parcel was assigned a loading manhole. All parcels with the same loading manhole were grouped together and their baseflow combined.

5.5.1 Existing Dry Weather Flow

The City's water billing database consisted of consumption data for each residential and commercial customer from 2001 to 2003. On average, water meters are read on six occasions per year. Additional meter readings are attributed to when an existing customer stopped service and a new customer started service at a particular location. Consumption from landscaping was removed by City staff prior to the baseflow estimation. The following methods were evaluated to estimate DWF.

- Method A - Average of all billing periods (2003).
- Method B - Average first five billing periods (2003).
- Method C - First billing period (2002 and 2003).
- Method D - First billing period and last billing period of previous year (2002 and 2003).

Ideally, water consumption would equal wastewater generation. In reality, water consumption is greater than wastewater generation due to irrigation and landscaping usage that does not enter the collection system. The goal is to use the method which produces wastewater flows closest to the one-to-one water consumption to wastewater generation ratio.

Method A and Method B closely resembled the method used in the 2003 Water Master Plan. These two methods consist of averaging water consumption during both wet and dry periods of the year. Since large quantities of irrigation water is included during dry periods, Methods A and B estimate unrealistically high sewer flows.

The wet and dry period flow calculation methods, Methods A and B, resulted in flows that were 3.5 to 4.0 mgd greater than using Methods C and D. Since wet weather water consumption is used in Methods C and D, both produced realistic sewer flows. During wet weather periods, irrigation water quantities are minimal because excess water is not needed due to rainfall. Ultimately, Method D was chosen because large fluctuations in water consumption impacted DWF estimations less since a greater number of billing records were used compared to Method C. Table 5.2 presents estimated wastewater flow from the different methods.

Table 5.2 Flow Calculation Methodology Wastewater System Master Plan City of Pleasanton						
Method	**Year**	**Flow Period**	**Description**	**Commercial Flow (mgd)**	**Residential Flow (mgd)**	**ADWF (mgd)**
A	2003	Wet and Dry	All billing periods	1.81	9.05	10.86
B	2003	Wet and Dry	Five billing period average from database	1.63	8.30	9.93
C	2002	Dry Only	Billing Period 1	1.27	5.20	6.47
C	2003	Dry Only	Billing Period 1	1.31	5.07	6.38
D	2002	Dry Only	Billing Period 1 & last from previous year	1.24	5.01	6.25
D	2003	Dry Only	Billing Period 1 & last from previous year	1.26	4.91	6.17

In addition to evaluating calculation methods, water consumption among the different years was also investigated. Year 2003 sewer flows were chosen since differences between 2002 and 2003 flows were minimal.

The City's service area was divided into seven basins, two of which are outside of this study. Basin 6 encompasses the Ruby Hill Basin. Wastewater discharges from Basin 6 flow to the City of Livermore Wastewater Treatment Plant. Basin 7 encompasses the area within City limits but tributary to DSRSD's main sewer pipeline entering the WWTP. Method D produced sewer flows equal to 6.17 mgd in 2003 in all seven basins. However, Basins 6 and 7 account for 0.47 mgd of DWF. This 0.47 mgd was subtracted from the total DWF estimate of 6.17 mgd. The resulting 5.73 mgd is generated in the five remaining basins applicable to this study. Figure 5.3 illustrates the service area for existing and build-out scenarios and delineates the basins within the system. Estimated wastewater flow by basin is presented in Table 5.3 while Table 5.4 summarizes wastewater flow by land use category. The existing DWF was then calibrated in the hydraulic model using flow data collected in the temporary flow-monitoring program.

5.5.2 Future Dry Weather Flow

A combination of water consumption and future land use were used to estimate future DWF. The following steps were used to estimate future flows:

- Identify and assign land use designations for future service areas.
- Calculate average City-wide DWF for each land use designation.

The future service area was obtained using a City database of vacant/future commercial and annexed/future residential property. Each parcel in the future service area was given its corresponding land use designation previously described in Chapter 2. An average city

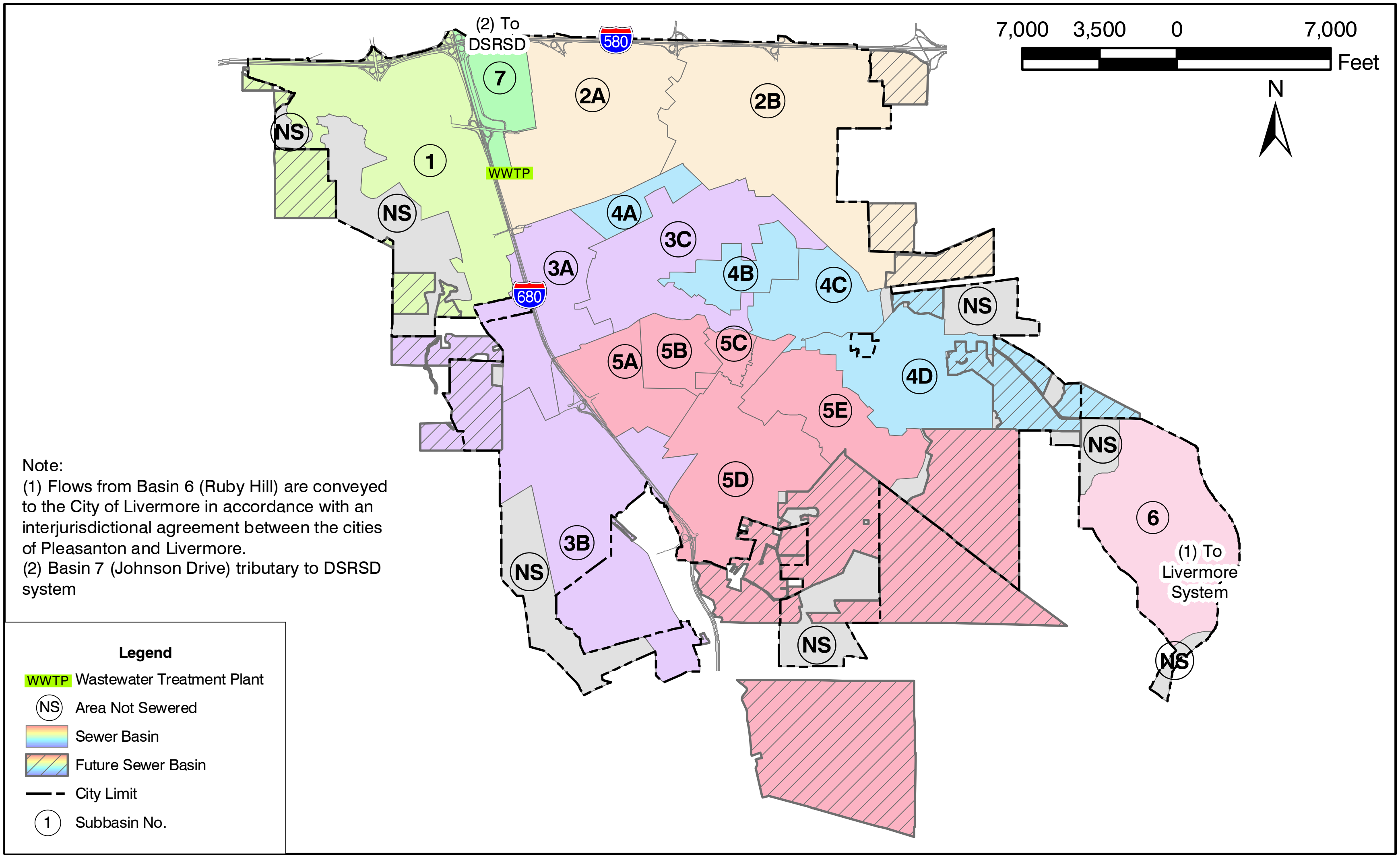

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Figure 5.3
SERVICE AREA
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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Table 5.3	Subbasin Average Dry Weather Flow Wastewater System Master Plan City of Pleasanton	
Subbasin	Existing (Year 2003)[1] (mgd)	Future[2] (mgd)
1	0.66	0.82
2A	0.66	0.75
2B	1.12	1.46
3A	0.42	0.47
3B	0.26	0.44
3C	0.65	0.63[6]
4A	0.05	0.05
4B	0.20	0.20
4C	0.10	0.22
4D	0.57	0.79
5A	0.03	0.05
5B	0.01	0.02
5C	0.06	0.05[6]
5D	0.46	1.27
5E	0.47	0.66
Total (Basins 1-5)[3]	**5.73**	**7.91**
6[4]	0.15	0.31
7[5]	0.29	0.15

Notes:
(1) Estimated from water billing records.
(2) Estimated from water billing records and future land use databases.
(3) Flows from Basin 6 (Ruby Hill) treated by the City of Livermore.
(4) Subbasin flows may not match total due to rounding.
(5) Within City boundaries (Johnson Drive) but tributary to DSRSD system.
(6) Decrease in dry weather attributable to change in land use.

Table 5.4	Average Dry Weather Flow by Land Use Wastewater System Master Plan City of Pleasanton		
Land Use	**Existing (Year 203) ADWF(1)(2) (mgd)**	**Future ADWF(3) (mgd)**	**Difference(4) (mgd)**
Agriculture	0.01	0.01	-0.01
Commercial	0.90	1.54	0.64
Industrial	0.05	0.22	0.17
Low Density Residential	0.54	0.66	0.11
Medium Density Residential	2.81	4.08	1.28
High Density Residential	1.27	1.29	0.02
Rural	0.07	0.06	0.00
Park	0.03	0.02	-0.01
Public	0.06	0.04	-0.02
Master Plan Total	**5.73**	**7.91**	**2.18**
Johnson Drive(5)	0.15	0.15	0.01
Ruby Hill(6)	0.29	0.31	0.02
City-Wide Total	**6.17**	**8.38**	**2.20**

Notes:
(1) ADWF = Average dry weather flow
(2) Estimated from water billing records.
(3) Estimated from water billing records and future land use databases.
(4) Decrease in dry weather attributable to change in land use.
(5) Within City boundaries (Johnson Drive) but tributary to DSRSD system.
(6) Flows from Basin 6 (Ruby Hill) treated by the City of Livermore.

wide DWF for each land use type was calculated by dividing the existing flow for a particular land use type by its total acreage within the City. The area of each parcel in the future service area was then multiplied by its corresponding flow factor to estimate future build-out DWF. Estimated DWF for the future condition is presented in Table 5.3. The future DWF for the City is estimated as 7.91 mgd (excluding Basins 6 and 7). This is an increase of 2.18 mgd over existing DWF.

5.5.3 CALIBRATION

Model calibration is a crucial component of the hydraulic modeling effort. The model must be calibrated to known flow metering data to ensure accurate predictions. The calibration process consists of matching both modeled and measured dry and WWF events. DWF calibration ensures an accurate depiction of baseflow generated within the City. The WWF calibration consists of calibrating the hydraulic model to storm events to quantify the peak flows and volume of I/I into the collection system. The amount of inflow and infiltration that enters the collection system is the difference between the total measured flow and the DWF.

5.5.4 DRY WEATHER FLOW CALIBRATION

The DWF calibration consists of two steps: (1) defining flow volumes for each parcel, and (2) creating diurnal curves to match the temporal distribution of flow.

The first step in the calibration process is to define the flow volumes for each parcel. This was achieved using the City's water billing records. After the flow volumes are input into each parcel, diurnal curves are created for all manholes tributary to a specific flow meter. The diurnal curves depict the time variation of baseflow throughout the day. Usually peaks in the diurnal curve occur in the morning, between 8 AM and 10 AM, and again in the evening between 6 PM and 8 PM Figure 5.4 presents an example diurnal curve used for the manholes tributary to Flow Meter 7. Similar diurnal curves were developed for each of the remaining ten flow meters and their tributary manholes.

The calibration process compares the flow metering data with the model output. Comparisons are made for minimum, maximum and average flows as well as the temporal distribution, or hydrograph shape. Table 5.5 summarizes the DWF calibration results using minimum, maximum and average flow results. An example of the DWF calibration for Flow Meter 7 is presented in Figure 5.5. The remaining DWF calibration plots are provided in Appendix F.

Industry standards indicate that dry weather calibration is considered acceptable when modeled and measured flows are within 0.1 mgd or 10 percent. No anomalies or difficulty was encountered during the DWF calibration process. The modeled ADWF simulated lower flows than metered ADWF at Meter Locations 5 and 10, however those were within 7 percent and will not impact the overall evaluation of the system.

5.5.5 WET WEATHER FLOW CALIBRATION

WWF calibration enables the modeled collection system to accurately predict infiltration and inflow entering a collection system during a storm event. WWF calibration consists of two steps: (1) determining a rainfall event that characterizes the most significant impact on the collection system facilities, preferably during wet antecedent soil moisture conditions and (2) creating a database of I/I parameters for each pipe for this rainfall event. The selected rainfall event should be representative of a typical wet weather storm. Ideally, the rainfall event will have a total volume very close to the design storm volume that is selected to assess the capacity of the collection system facilities. GWI can be an influential component of defects if the groundwater table is above the invert elevation of the pipelines. Thus, the calibration storm event should be selected such that the groundwater table is at or near

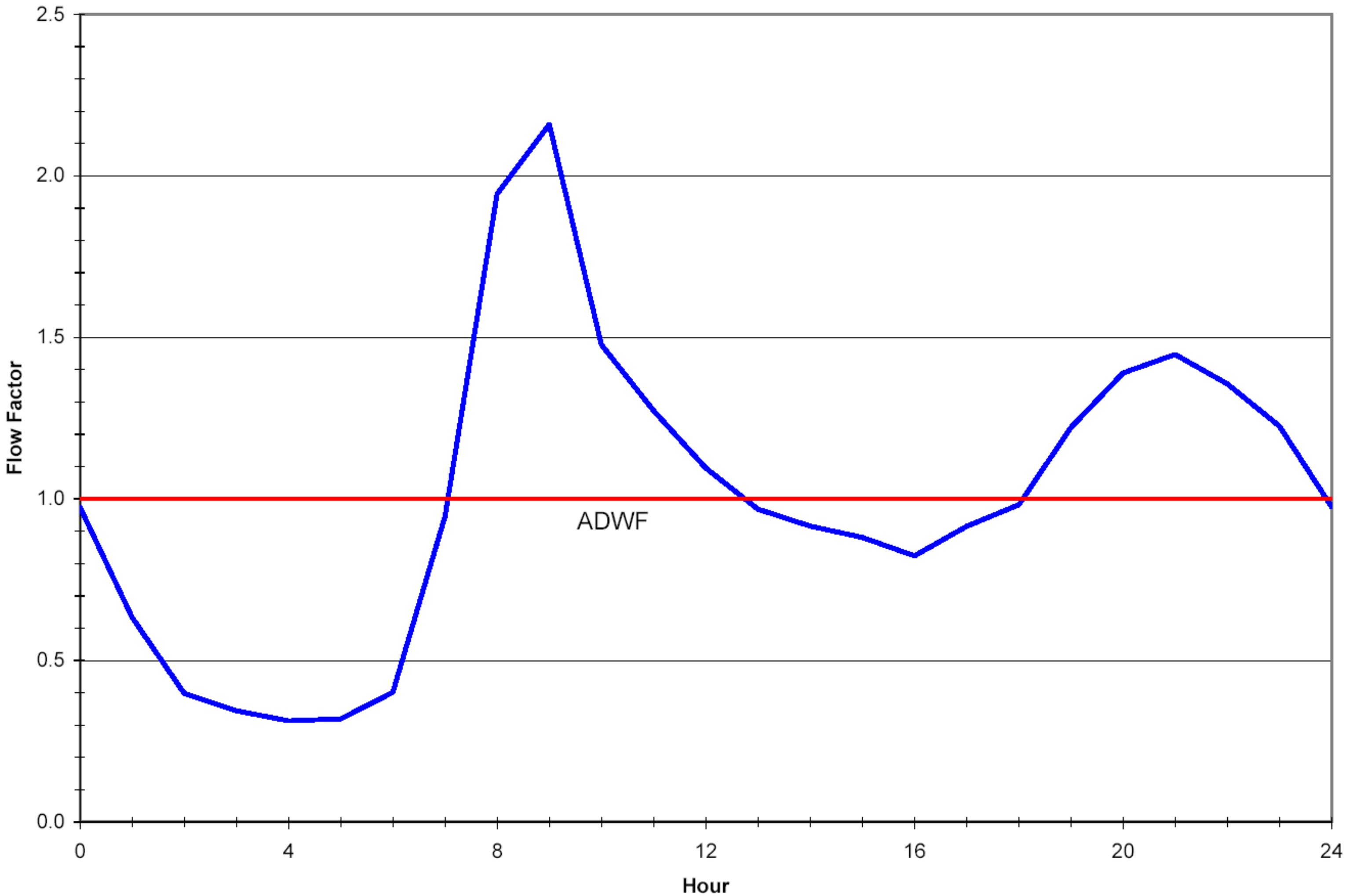

Figure 5.4
EXAMPLE DIURNAL CURVE
METER 7
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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Table 5.5	Dry Weather Flow Calibration Summary Wastewater System Master Plan City of Pleasanton			
Meter I.D.	**Metered ADWF[1] (mgd)[2]**	**Modeled ADWF (mgd)[2]**	**Difference (mgd)[2]**	**Percent Difference (%)**
M1	0.68	0.69	+0.01	+1.5
M2	1.57	1.57	0.00	0.0
M3	0.84	0.85	+0.01	+1.2
M4	1.07	1.10	+0.03	+2.8
M5	0.95	0.93	-0.02	-2.1
M6	0.61	0.64	+0.03	+4.9
M7	0.48	0.51	+0.03	+6.3
M8	1.01	1.06	+0.05	+5.0
M9	0.22	0.23	+0.01	+4.5
M10	0.93	0.87	-0.06	-6.5
M11	0.42	0.40	-0.02	-4.8

Notes:
(1) ADWF = Average Dry Weather Flow.
(2) mgd = million gallons per day.

its maximum height. This allows the model to be calibrated to the worst-case scenario. Other factors such as the age and condition of the collection system facilities will impact the quantity of I/I into the system. Typically, older sewer pipes will have a greater tendency to allow I/I into the collection system than newer pipes.

WWF was calibrated using H2OMAP Sewer’s tri-triangle method. This method uses three triangular synthetic unit hydrographs to simulate I/I caused by rainfall. The first triangle represents rapid response sources usually associated with direct inflow. The second triangle represents medium response components. The third triangle represents slow response components such as groundwater and long-term infiltration. Each triangle uses three parameters in combination with an associated drainage area. The three parameters are the effective rainfall percentage, R, the time to peak, T, and the recession constant, K. The R, T, and K parameters were adjusted until I/I closely matched the metered flow. Figure 5.6 illustrates the triangular synthetic hydrograph method.

5.5.5.1 February 2004 Calibration

During the flow-monitoring period, three significant rainfall events occurred. The model was calibrated to WWF for the February 17 through18, 2004 rainfall event. WWF calibration was verified using the February 25 through 27 rainfall event. A summary of the five rain gauges

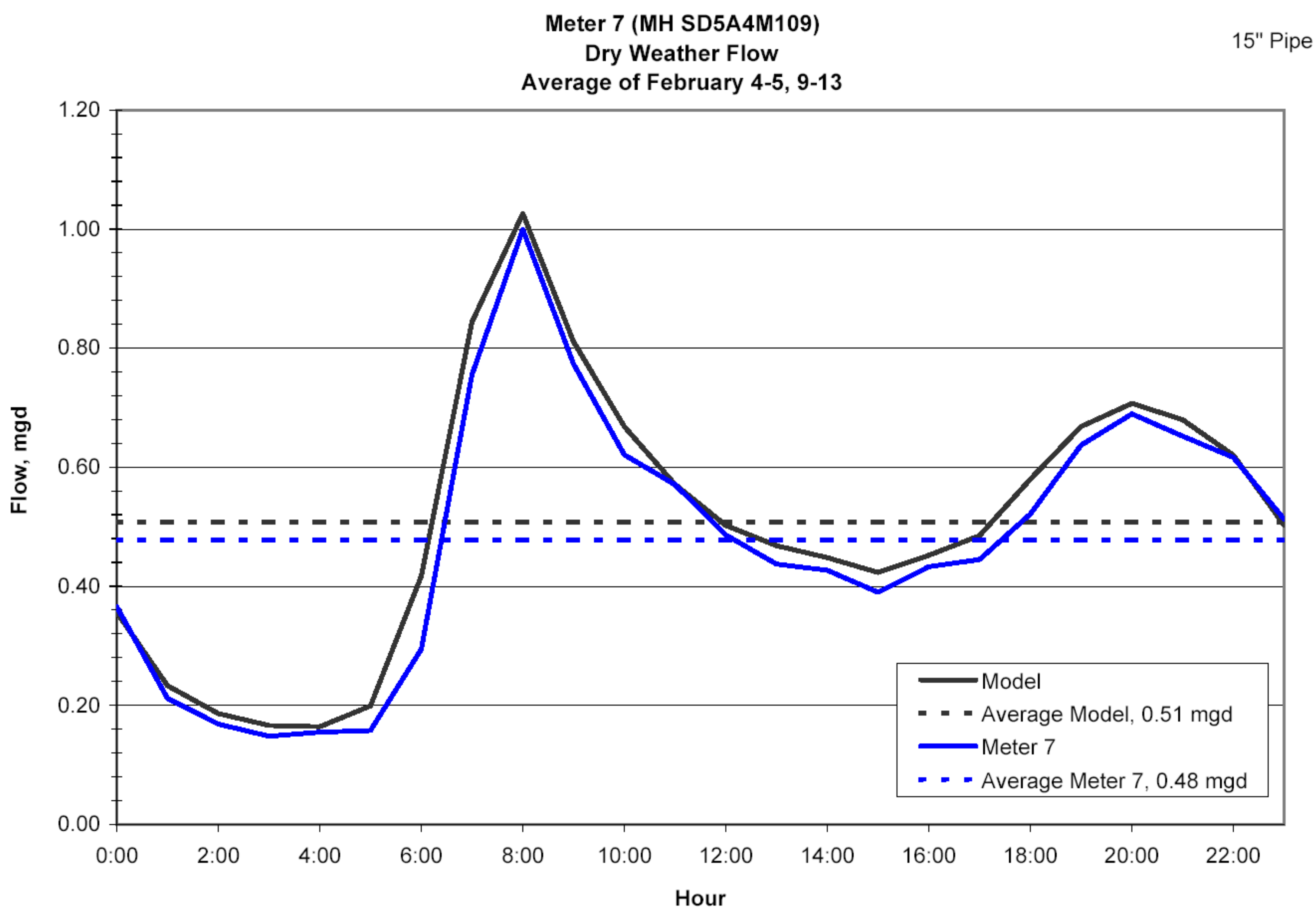

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Figure 5.5
EXAMPLE DRY WEATHER CALIBRATION
METER 7
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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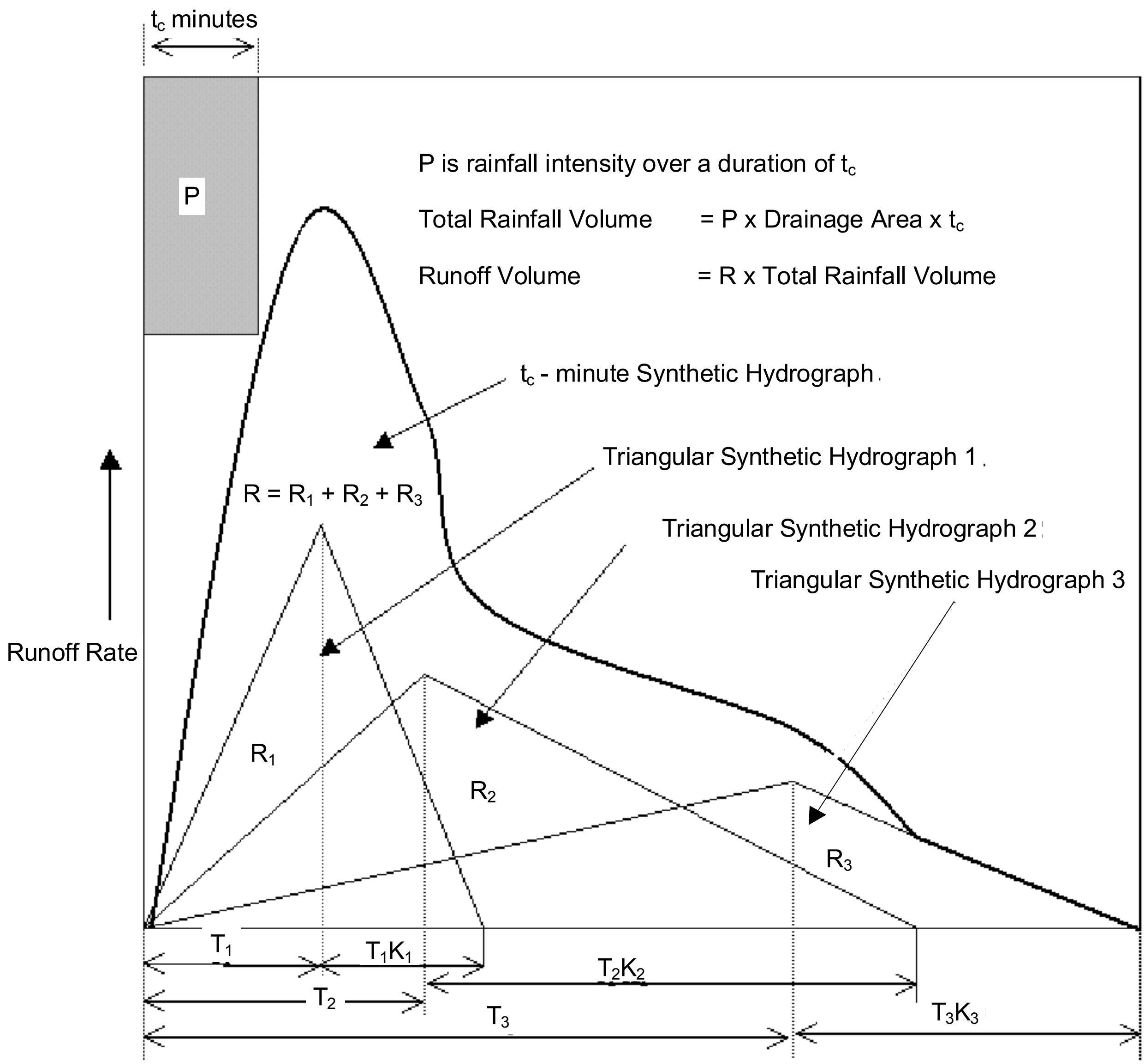

Source: H2OMAP Sewer User's Manual (2004).

Figure 5.6
TRI-TRIANGLE SYNTHETIC UNIT HYDROGRAPH METHOD
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

used in the calibration process was presented previously in Table 4.1. The rainfall event totaled 1.27 inches at Rain Gauge A, 0.77 inches at Rain Gauge B, 0.53 inches at Rain Gauge C, 1.28 at Rain Gauge D, and 1.18 inches at Rain Gauge E for the February 17 through18 rainfall event. The location of each rain gauge was illustrated previously in Figure 4.1.

Appendix G contains WWF calibration plots for all meters. Table 5.6 summarizes the WWF calibration effort. The table compares metered vs. modeled flows, and lists the difference between the two in mgd units and as a percentage. Wet weather calibration is considered acceptable when modeled and measured flows are within 0.1 mgd or 10 percent in accordance with industry standards. The model simulated lower flows at Meter Locations 2, 4, 5, 7 and 10. However these were within 7 percent and will not impact the overall evaluation of the system.

5.5.5.2 December 2005 Calibration

Following the completion of the 2004 calibration, the hydraulic model calibration was refined using a significant rainfall event from December 30, 2005 through January 1, 2006. During the peak 24 hours of this storm, 3.81 inches of rainfall was recorded. Using historical precipitation data from the National Oceanographic and Atmospheric Administration (NOAA), this rainfall event is approximately a 5-year event (a storm that has the probability to occur once every 5 years). Flow data was obtained from the City and the model calibrated at each of the City's four outfalls. These are the Highland Oaks Siphons, PS S-6, PS S-8, and the East Amador Lift Station.

Since only four locations were calibrated, it was necessary to combine sewer basins for calibration purposes. In some cases, outfall basin encompassed multiple basins from the February 2004 calibration. The February 2004 wet weather calibrations were individually adjusted to match the outfall flow. I/I was distributed according to approximate 2004 calibration percentages and not equally distributed throughout the modified outfall basin. Dry weather inputs were not adjusted. Appendix H contains WWF calibration plots for the four outfall locations. Table 5.7 summarizes the December 2005 WWF calibration effort. The table compares metered vs. modeled flows, and lists the difference between the two in mgd units and as a percentage. Wet weather calibration is considered acceptable when modeled and measured flows are within 0.1 mgd or 10 percent in accordance with industry standards. The Highland Oaks calibration exhibited a 23.7 percent difference in PWWF. This was due to the measured flow having approximately 0.2 mgd of additional dry weather flow than was input to the model during February 2004 calibrations. Since the purpose of the December 2005 calibration effort was to adjust wet weather flows, the difference in dry weather flow was ignored. When comparing the wet weather components of flow only, the calibration is within industry standards. The remaining outfall calibrations fell within industry standards. The hydraulic model is well suited to estimate I/I and identify capacity deficiencies with the two calibrations as a foundation.

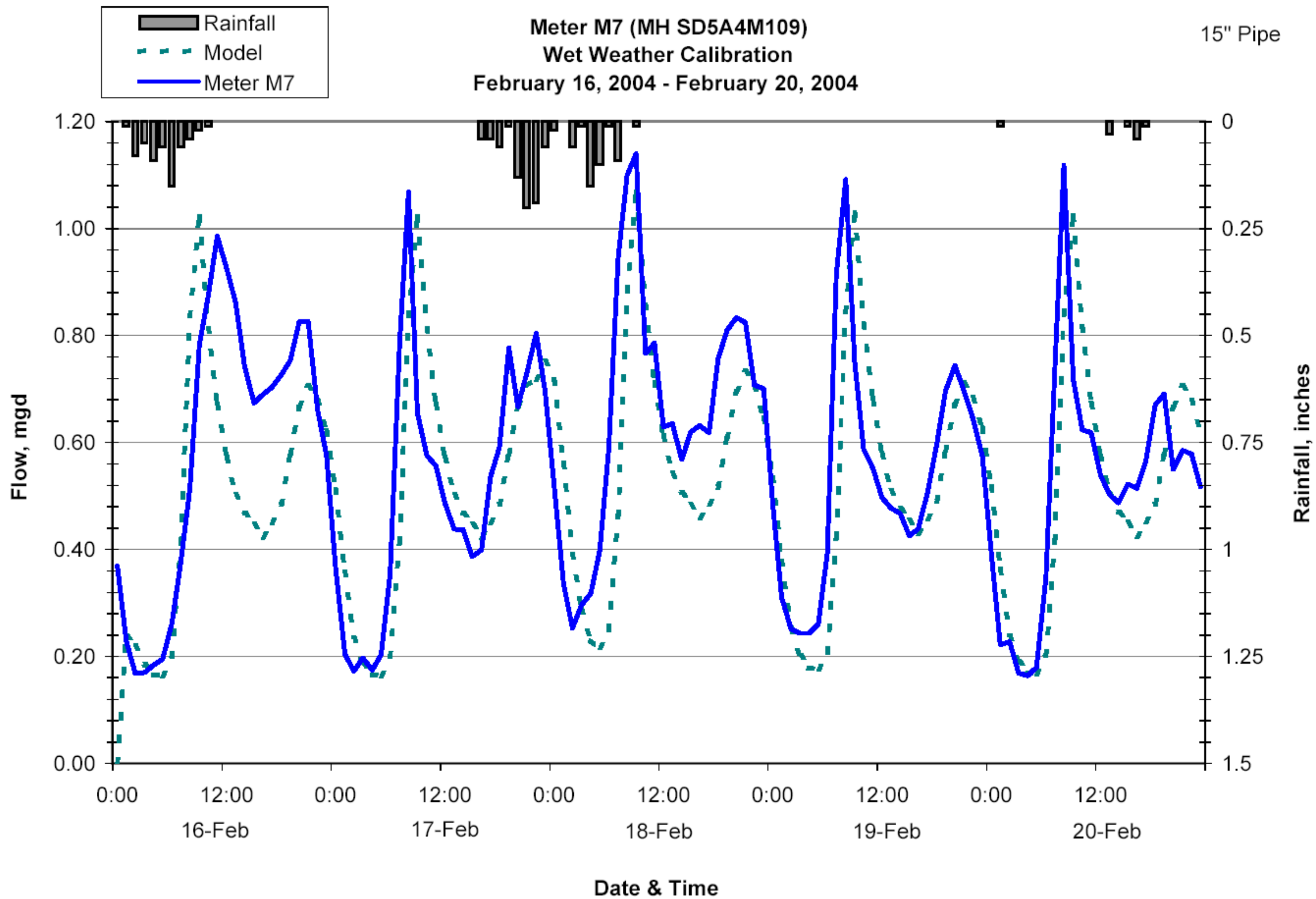

Figure 5.7
EXAMPLE WET WEATHER CALIBRATION
METER 7
WASTEWATER SYSTEM MASTER PLAN
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Table 5.6 February 2004 Wet Weather Flow Calibration
Wastewater System Master Plan
City of Pleasanton

Meter I.D.	Metered PWWF(1) (mgd)(2)	Modeled PWWF (mgd)	Difference (mgd)	Percent Difference (%)
M1	1.26	1.27	0.01	0.9
M2	3.94	3.93	-0.01	-0.2
M3	2.74	2.76	0.03	1.0
M4	3.18	3.13	-0.06	-1.8
M5	2.05	1.98	-0.07	-3.5
M6	1.12	1.22	0.10	8.6
M7	1.14	1.07	-0.07	-6.3
M8	2.15	2.20	0.04	2.0
M9	0.57	0.57	0.01	1.4
M10	1.92	1.89	-0.03	-1.6
M11	0.69	0.74	0.05	6.7

Notes:
(1) PWWF = Peak Wet Weather Flow.
(2) mgd = million gallons per day.

Table 5.7 December 2005 Wet Weather Flow Calibration
Wastewater System Master Plan
City of Pleasanton

Meter I.D.	Metered PWWF(1) (mgd)(2)	Modeled PWWF (mgd)	Difference (mgd)	Percent Difference (%)
HO(3)	1.02	1.27	0.24	23.7%(5)
PS S-6	4.68	4.72	0.04	0.9%
PS S-8	3.16	3.18	0.02	0.6%
EALS(4)	5.47	5.54	0.07	1.3%

Notes:
(1) PWWF = Peak Wet Weather Flow
(2) mgd = million gallons per day
(3) HO = Highland Oaks
(4) EALS = East Amador Lift Station
(5) Difference due to ~0.2 mgd increase in metered dry weather flow

CAPACITY ANALYSIS

6.1 INTRODUCTION

Upon completion of the dry and wet weather flow calibration, a capacity analysis of the modeled collection system was performed. The capacity analysis entailed identifying areas in the collection system where flow restrictions occur or where pipe capacity is insufficient to pass peak wet weather flow (PWWF) events. Pipes that do not have sufficient capacity to pass PWWF can produce backwater effects in the collection system and potentially cause unwanted sanitary sewer overflows (SSO). Typically, a design storm is used to quantify the PWWFs in the collection system and coupled with design criteria, allows for an analysis of collection system capacities.

6.2 PLANNING AND DESIGN CRITERIA

The capacity of the City's sanitary sewer system was evaluated based on the analysis and design criteria defined in this chapter. Historical flows at the wastewater treatment facility were reviewed and analyzed to determine fluctuations in daily, monthly, and seasonal flows. The developed criteria address the sewer system capacity, acceptable pipe slopes, acceptable depths of flow within pipes, minimum and maximum velocity of flow, and minimum pipe size.

6.2.1 GRAVITY SEWERS

Capacity analysis of the gravity sewers was performed in accordance with the criteria established in this section.

6.2.1.1 Pipe Capacities

Sewer pipe capacities are dependent on many factors. These include roughness of the pipe, geometric configuration (cross-section and length), and slope. The Continuity equation and the Manning equation for steady-state flow can be used to calculate flow in a sewer pipe:

Continuity Equation: $$Q = V*A$$

Where:

Q = peak flow, cubic feet per second (cfs)
V = velocity, feet per second (fps)
A = cross-sectional area of pipe, square feet (sf).

$$\text{Manning Equation:} V = (1.486 * R^{2/3} * S^{1/2})/n$$

Where:

V = velocity, fps

n = Manning's coefficient of friction

R = hydraulic radius (area divided by wetted perimeter), feet

S = slope of pipe, feet per foot

6.2.1.2 Manning Coefficient (n)

The Manning coefficient 'n' is a friction coefficient and varies with respect to pipe material, size of pipe, depth of flow, smoothness of joints, root intrusion, and other factors. For sewer pipes, the Manning coefficient typically ranges between 0.011 and 0.017, with 0.013 being a representative value used for system master planning purposes.

6.2.1.3 Allowable Slopes and Velocity

In order to minimize the settlement of sewage solids, it is standard design practice to specify that a minimum velocity of 2 feet per second (fps) be met or exceeded at least once per day. At this velocity, the sewer flow will typically provide self-cleaning. Due to hydraulics of a circular conduit, velocity of half-full flow in pipes approaches the velocity of nearly full flow in pipes. The minimum acceptable slopes, based on 2 fps velocity, for sewer pipe sizes are located in the City Design Guide and should be adjusted if flow characteristics are changed. The maximum velocity in a pipe should not exceed 10 fps, unless special provisions are made in order to mitigate odor, agitation and loss of solid in the flow. In addition, public sewers should be designed so the minimum pipe size is 8-inches in diameter.

6.2.1.4 Flow Depth (d/D) and Surcharge Criteria

When designing sewer pipelines, it is a common practice to adopt variable flow depth criteria for various pipe sizes. This criteria is expressed as a maximum depth of flow to pipe diameter ratio (d/D). Design d/D ratios typically range from 0.5 to 1.0, with the lower values typically used for smaller pipes - which may experience flow peaks greater than planned or may experience blockages from debris, paper, or rags. A pipe is said to be “capacity deficient” when it is flowing greater than 75 percent full (i.e. d/D is greater than 0.75) under dry weather flow conditions. The City uses a design d/D ratio of 0.75 for designing new gravity sewer pipes. This value was used in analyzing the system under existing and build-out dry weather flow conditions.

In determining deficient pipes under wet weather flow conditions a design storm generating infiltration and inflow (I/I) is routed thorough the collection system in the hydraulic model. The hydraulic model determines which pipelines in the collection system are unable to convey the peak wet weather flows (PWWF) caused by the design storm. The City has established a PWWF criteria upon which to make improvements in the collection system.

The PWWF criteria (or surcharge criteria), established by the City, allows the hydraulic grade line (HGL) to surcharge up to one foot below the manhole rim elevation. A pipeline is surcharged when the hydraulic grade line rises above the crown elevation of the pipe and deficient when the HGL is less than one foot below the manhole rim elevation.

This criteria was used to determine which pipelines in the modeled collection system are capacity deficient. Upon identifying these pipelines, the collection system hydraulic model is restructured to replace deficient sewers and provide additional capacity. Several sections of pipeline in the collection system will be full during the PWWFs of the design storm and yet will not require improvements because backwater effects do not elevate the HGL above the City's surcharge criteria.

6.3 DESIGN STORM

Design storms are synthetic rainfall events used to analyze the performance of a collection system under peak flows and volumes. Design storms have a specific recurrence interval and rainfall duration. The development of rainfall intensity, pattern and total volume are critical steps in developing a realistic design storm for the City.

6.3.1 Coordination with DSRSD

The Dublin-San Ramon Services District (DSRSD), is also in the process of completing a wastewater master plan. An effort was made to coordinate design storms for both entities since flow is treated at a common wastewater treatment plant (WWTP). Discrepancies in the return period and volume of the design storm led to an agreement to retain the services of Jack Humphrey, Ph.D. of Hydmet, Inc. Dr. Humphrey is a well respected meteorologist. Jack Humprey has performed work for DSRSD's consultant, Montgomery Watson Harza, and Pleasanton's consultant, Carollo Engineers, P.C. (Carollo) in the past. Hydmet's rainfall analysis provides an independent opinion for both DSRSD and the City. A summary of Hydmet's analysis is presented in the following section.

6.3.2 Rainfall Analysis

The rainfall analysis used a multitude of sources in determining design storm volumes. The following sources were primarily used in the rainfall analysis.

- California Department of Water Resources (DWR) Bulletin 190.
- California Data Exchange Center (CDEC).
- National Oceanic and Atmospheric Administration (NOAA) Atlas 2.
- United States Geological Survey (USGS) Annual Precipitation Map of California.
- National Climatic Data Center (NCDC) daily and hourly precipitation records.
- Short-term recent precipitation records for Pleasanton rain gauges.

Using the above sources, rainfall volumes for design storms of 5 and 10-year return periods were developed. The 24-hour duration design storm was considered since it is most representative of rainfall that occurs the San Francisco Bay Area. A detailed description of the rainfall analysis performed by Hydmet is located in Appendix I. A nationwide rainfall pattern was used to distribute the volume within the 24-hour duration. At Interstate-680, a 5-year design storm is expected to have a volume of 3.74 inches with a peak intensity of 0.81 inches per hour and a 10-year design storm a volume of 4.81 inches and a peak intensity of 1.04 inches per hour. Both of these storms, in addition to the December 2005 calibration event, were evaluated using the hydraulic model for appropriateness.

6.3.3 Selection of Design Storm

Following the completion of the rainfall analysis, a sensitivity analysis was performed to determine the appropriate design storm to use in determining system improvements. The collection system was evaluated under existing and future dry weather flow conditions using both the 5-year 24-hour and 10-year 24-hour design storms. In addition, the December 2005 calibration storm was used for comparison. The results of the sensitivity analysis are presented in Table 6.1. At future flow conditions, the 5-year design storm estimates 18 sanitary sewer overflows (SSO) would occur. Under the 10-year design storm 29 SSOs are projected. Due to the relatively small increase in projected SSOs, the 10-year 24-hour design storm was selected to evaluate the collection system. The decision to use the 10-year 24-hour design storm will result in a bigger and costlier Capital Improvement Program, the larger storm provides the City a greater level of protection while maximizing funds spent.

When compared to the design storm used by DSRSD in evaluating its system, the City's 10-year 24-hour design storm is comparable. DSRSD has chosen to use a 20-year 6-hour design storm in analyzing its system. Figure 6.1 presents the rainfall distribution pattern of the 10-year 24-hour design storm.

6.4 COLLECTION SYSTEM CAPACITY EVALUATION

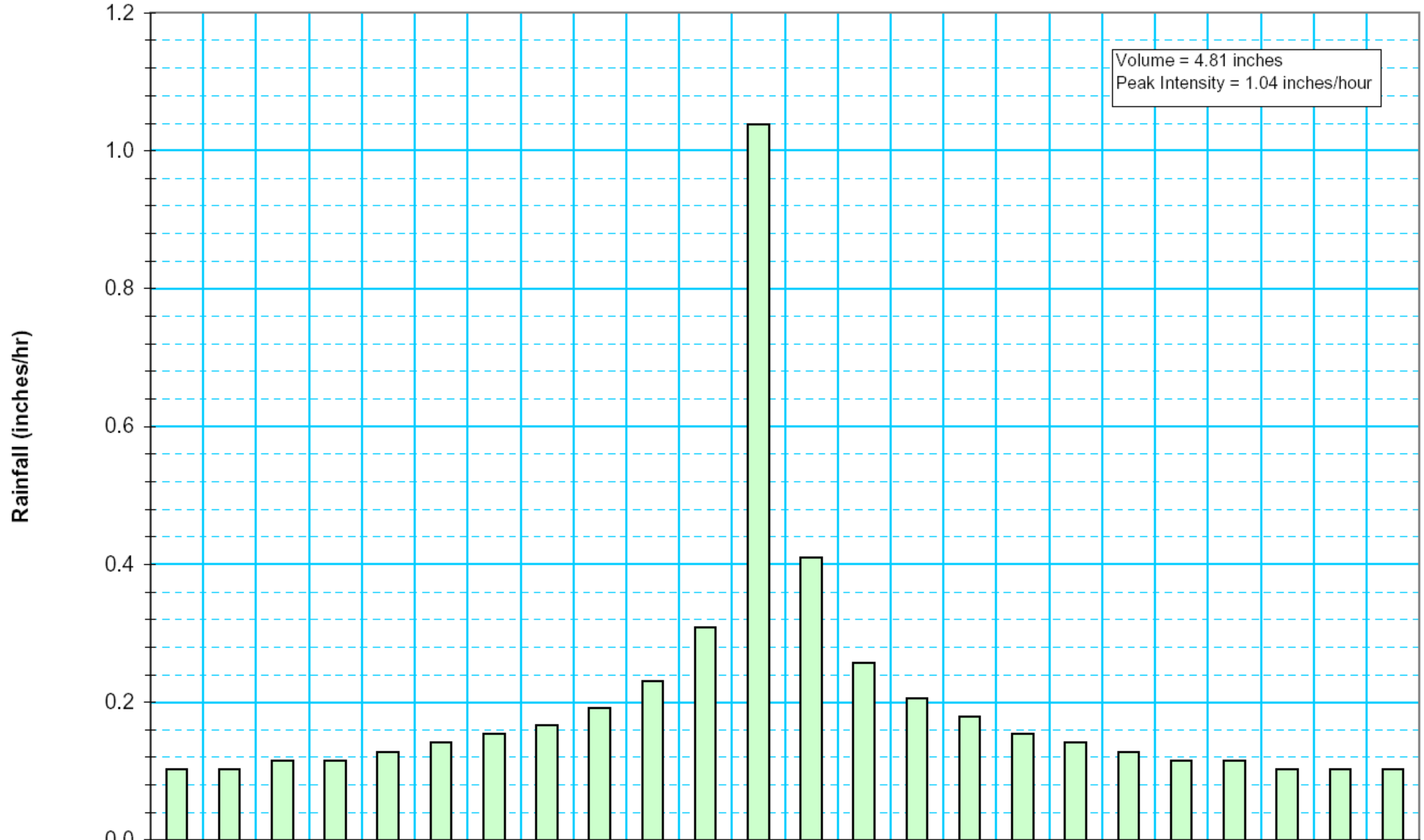
The City's collection system was analyzed using the 10-year 24-hour design storm to determine the system capacity deficiencies. The capacity analysis was performed for the following four conditions.

- Existing (Year 2003) Condition:
  - Peak Dry Weather Flow.
  - Peak Wet Weather Flow (10-Year 24-Hour Design Storm).
- Future Condition:
  - Peak Dry Weather Flow.
  - Peak Wet Weather Flow (10-Year 24-Hour Design Storm).

Table 6.1 Design Storm Comparison
Wastewater System Master Plan
City of Pleasanton

	December 2005	5-Year, 24-Hour Design Storm	5-Year, 24-Hour Design Storm	10-Year, 24-Hour Design Storm	10-Year, 24-Hour Design Storm
Flow Characteristics					
Dry Weather Flow	Existing	Existing	Future	Existing	Future
Base Infiltration (MGD)	0.00	1.41	1.41	1.41	1.41
Storm Characteristics					
Volume (Inches)	2.95	3.74	3.74	4.81	4.81
Peak Intensity (in/hr)	0.49	0.81	0.81	1.04	1.04
PWWF(1) (MGD)	14.5	15.2	18.6	17.0	20.5
Pipeline Capacity					
d/D(2) < 0.75	2,059	2,048	2,007	2,018	1,972
0.75 < d/D < 1	21	17	17	6	28
d/D = 1	24	47	97	70	115
Manhole Depth					
SSO(3)	3	3	18	4	29
< 1 ft below rim	0	2	8	3	10
1 - 3 ft below rim	14	15	47	29	43
3 - 5 feet below rim	49	47	65	71	73
> 5 ft below rim	1,966	1,957	1,911	1,917	1,887

Notes:
(1) PWWF = Peak wet weather flow
(2) d/D = Depth to diameter flow ratio
(3) SSO = Sanitary sewer overflow



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
10-Year	0.10	0.10	0.12	0.12	0.13	0.14	0.15	0.17	0.19	0.23	0.31	1.04	0.41	0.26	0.21	0.18	0.15	0.14	0.13	0.12	0.12	0.10	0.10	0.10

Hour

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Figure 6.1
10-YEAR 24-HOUR
DESIGN STORM HYETOGRAPH
WASTEWATER SYSTEM MASTER PLAN
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The collection system response for the four conditions described above are provided below. The City anticipates growth in the future to occur in the eastern and southern portions of the City. In addition, some growth will be infill development of vacant parcels and the annexation of parcels on the peripheral of the City boundary. The collection system capacity analysis revealed modest impact from the developments in the eastern and southern areas of the City. Most of the relatively few deficiencies in the modeled collection system based on the capacity analysis are due to I/I from storm events. The design storm was simulated such that the generated peak hourly wet weather flows coincided with the peak hourly dry weather flow (DWF). This results in an analysis under worst-case conditions.

6.4.1 Baseline Inflow and Infiltration

Under wet weather conditions, baseline inflow and infiltration totaling 1.41 mgd was added to the model. As precipitation continues to fall during the wet weather season, groundwater levels increase. In some areas, groundwater levels increase to the point where it is above the pipeline. In other areas, the groundwater level rises and remains below the pipeline but prevents soils from adequately draining. This results in quicker and longer responses to rainfall entering the system. The 1.41 mgd of baseline I/I was estimated using historical flow data from a LAVWMA study and distributed evenly across the City.

6.4.2 Existing PDWF Capacity Analysis

The collection system was analyzed in the hydraulic model under existing DWF (Year 2003) conditions to identify capacity deficiencies. There were five pipelines that did not meet the City's dry weather flow capacity criterion of d/D = 0.75 (depth of flow to diameter ratio of 0.75). However, only two pipelines in the downtown area are of concern. The remaining three pipes each have little or no slope and do not create backwater effects upstream. Figure 6.2 illustrates the deficient pipes which did not meet the City's flow depth criteria.

The City's average dry weather flow (ADWF) contribution to the WWTP is 5.70 million gallons per day (mgd). The ADWF is based on water consumption records and does not include flows from Basin 6 (Ruby Hill) and Basin 7 (Johnson Drive)). The 5.70 mgd is less than the 5.73 mgd input to the model to flow attenuation. In addition, the minimum hourly DWF conveyed is 2.08 mgd with a peak hourly flow of 8.41 mgd.

6.4.3 Existing PWWF Capacity Analysis

The collection system was analyzed using the 10-year 24-hour design storm with existing DWF (Year 2003). There were approximately 7 manholes that did not meet the City's wet weather surcharge of one foot below rim elevation. Figure 6.3 illustrates the deficient areas of the collection system. The areas of greatest concern in the collection system are in Basin 2B south of the Arroyo Mocho Canal, Basin 5D along Sunol Boulevard, and Basin 5E along

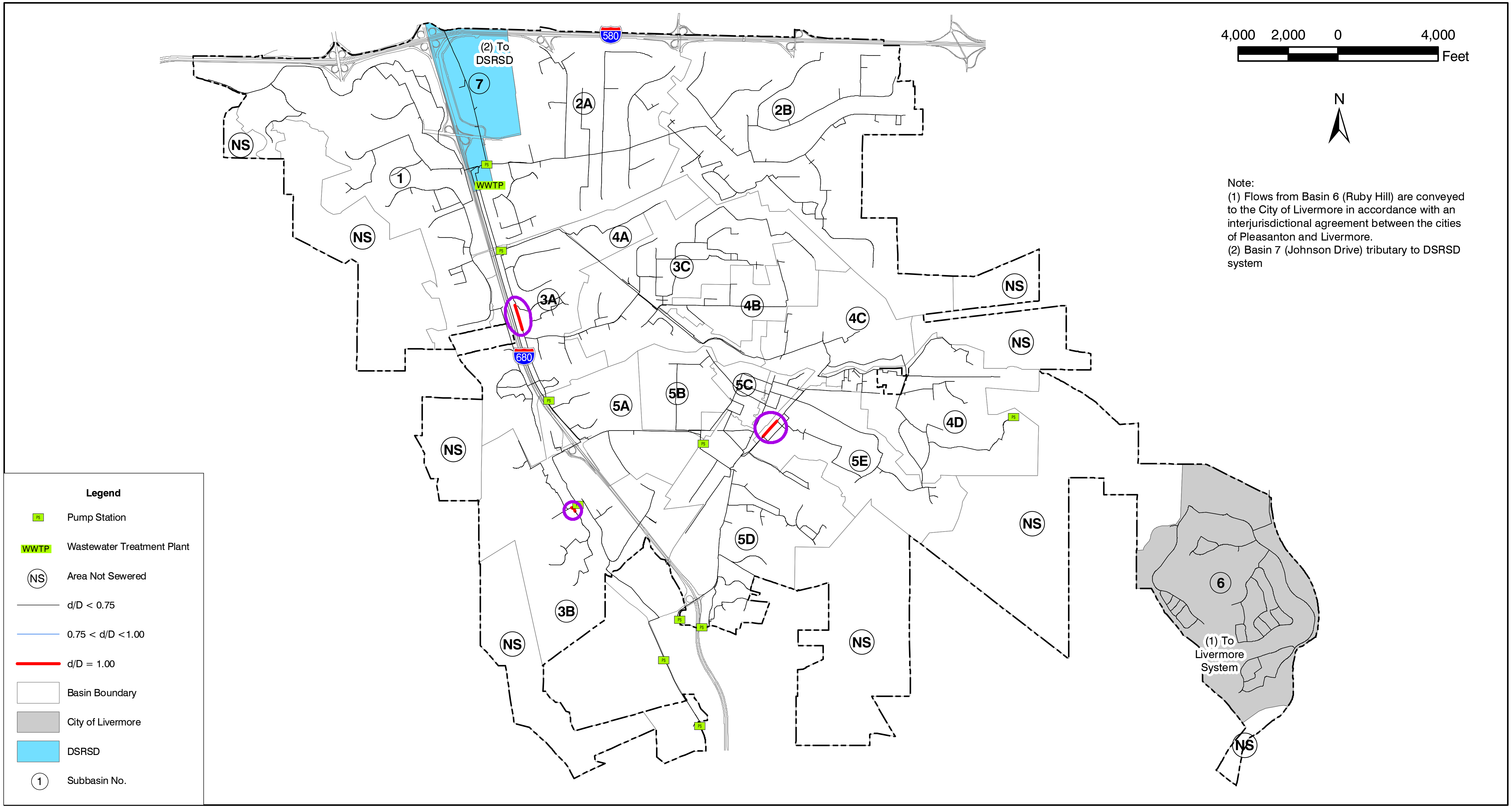

Figure 6.2
CAPACITY ANALYSIS
EXISTING PDWF
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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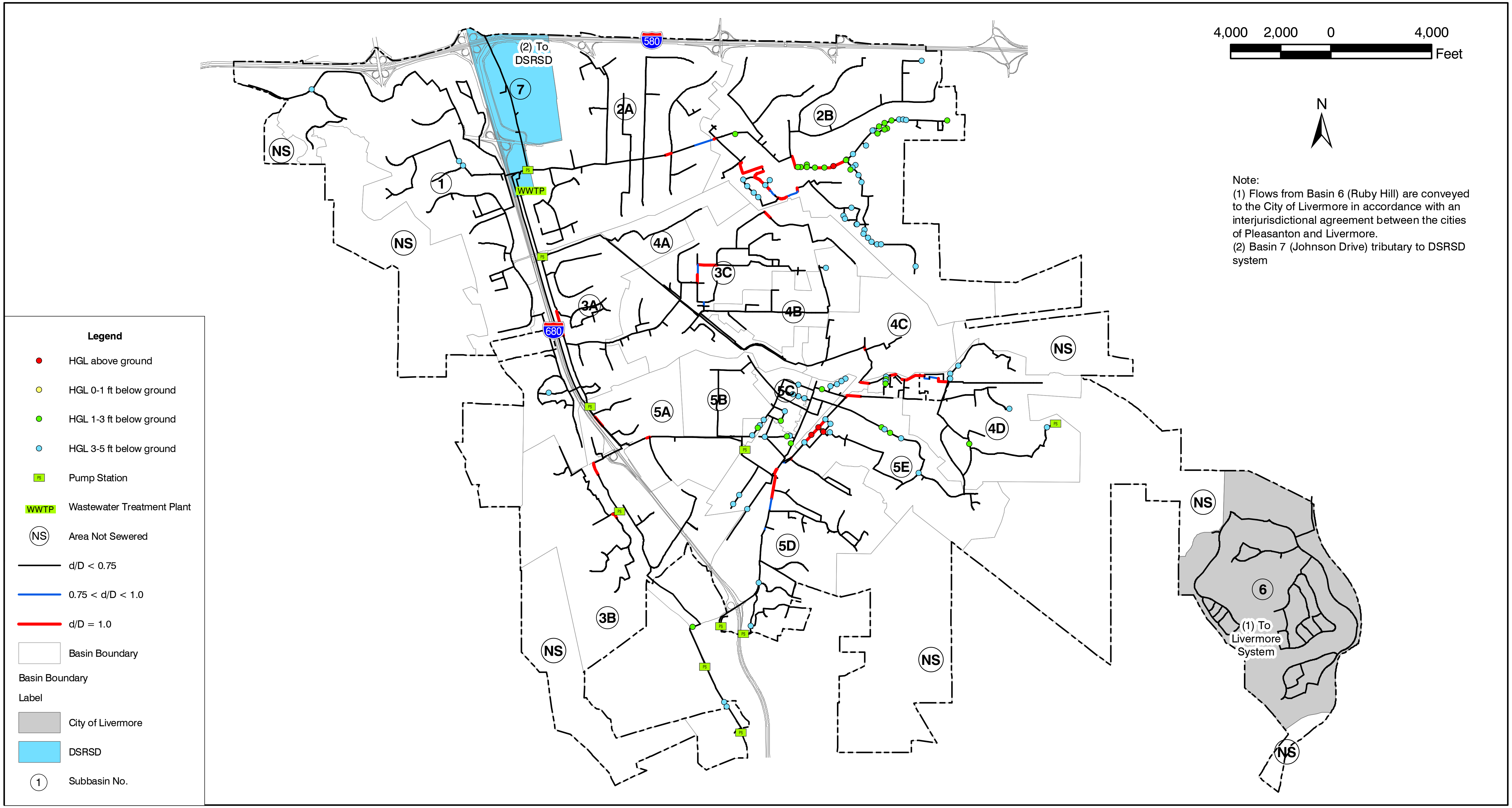

Figure 6.3
CAPACITY ANALYSIS
EXISTING PWWF
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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First Street. The City's PWWF at the WWTP during the 10-year 24-hour design storm for the existing flow condition is estimated to be 17.0 mgd including baseline I/I.

6.4.4 Future DWF Capacity Analysis

Under future dry weather flow conditions a total of 41 pipes (including the five from the existing flow condition) do not meet the City's dry weather flow capacity criterion of d/D = 0.75 and are considered deficient. The future flow condition is increased 2.18 mgd from the existing flow condition. Some of these are caused by pipes with little or no slope. Most of the deficient pipes are located in Basin 5D, where most growth is expected. Figure 6.4 illustrates the deficient pipes which did not meet the City's flow depth criterion.

Under future flow conditions, the City's ADWF contribution to the WWTP is 7.52 mgd. In addition, the minimum hourly DWF conveyed is 3.05 mgd with a peak hourly flow of 11.6 mgd.

6.4.5 Future PWWF Capacity Analysis

The collection system was analyzed using the 10-year 24-hour design storm with future DWF. Modeled WWF was kept constant. There were approximately 39 manholes that did not meet the City's wet weather surcharge of one foot below rim elevation. Figure 6.5 illustrates the deficient areas of the collection system. There are no additional areas of concern. However, the increase in DWF has exacerbated areas of concerns previously identified. The City's PWWF at the WWTP during the 10-year 24-hour design storm for the future flow condition is estimated to be 21.5 mgd including baseline I/I. A summary of the modeled DWF and PWWF (10-year 24-hour design storm) for the capacity analysis hydraulic modeling simulations are presented in Table 6.2. Existing and future peak wet weather flows are illustrated in Figure 6.6.

6.5 PUMP STATION CAPACITY ANALYSIS

A pump station capacity analysis was conducted to determine pump station deficiencies. Each pump station was analyzed using ADWF, PDWF, and PWWF flows for the existing and future conditions. PWWF includes wet weather from the 10-year 24-hour design storm and baseline inflow and infiltration. Table 6.3 summarizes the pump station capacity analysis.

Under existing flow (Year 2003) conditions, two pump stations are deficient. A third pump station, PS-8 is at capacity.

- EALS: PWWF 3.09 mgd over firm capacity.
- PS-6: PWWF 2.01 mgd over firm capacity.

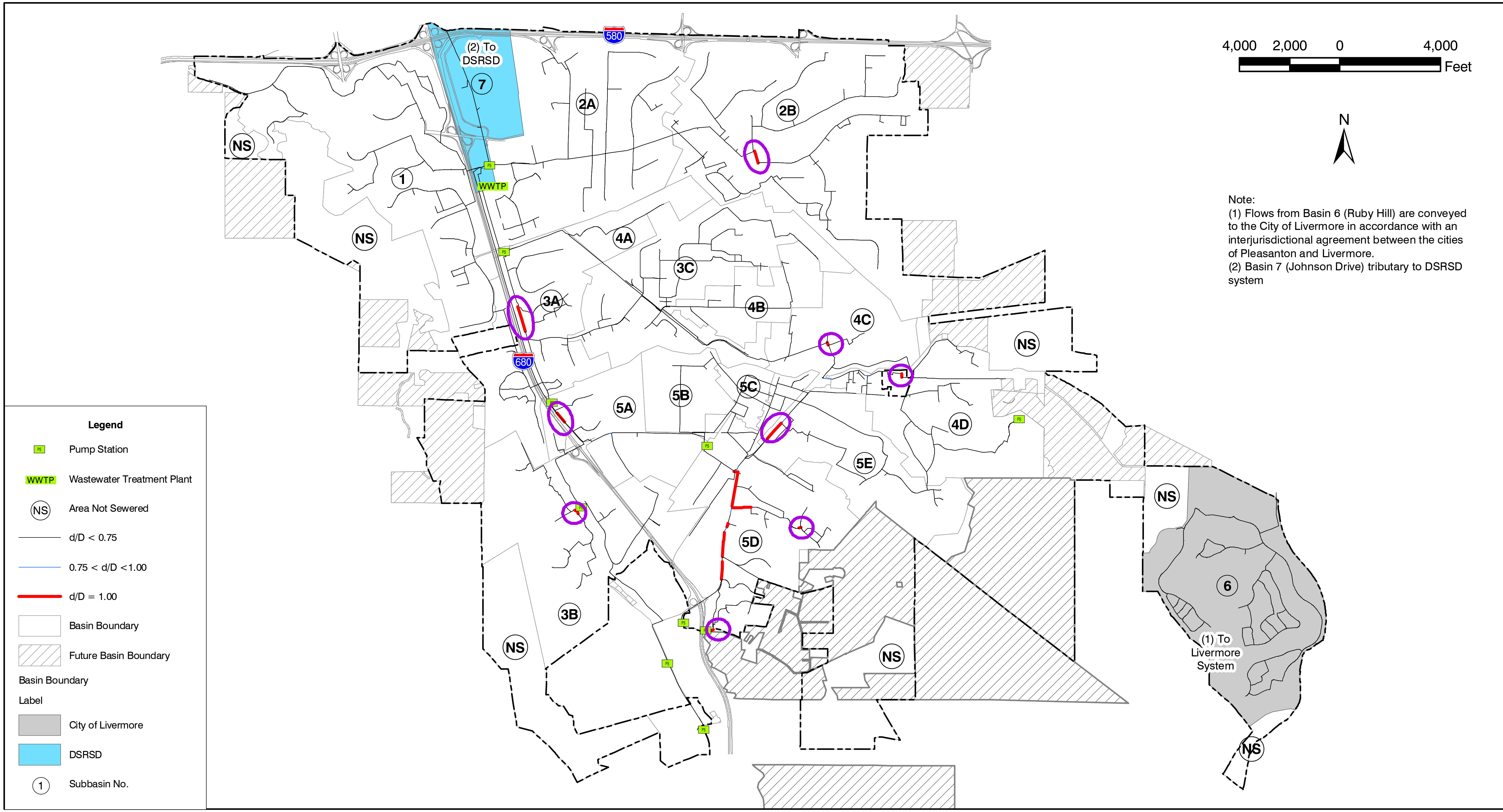

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Figure 6.4
CAPACITY ANALYSIS
FUTURE PDWF
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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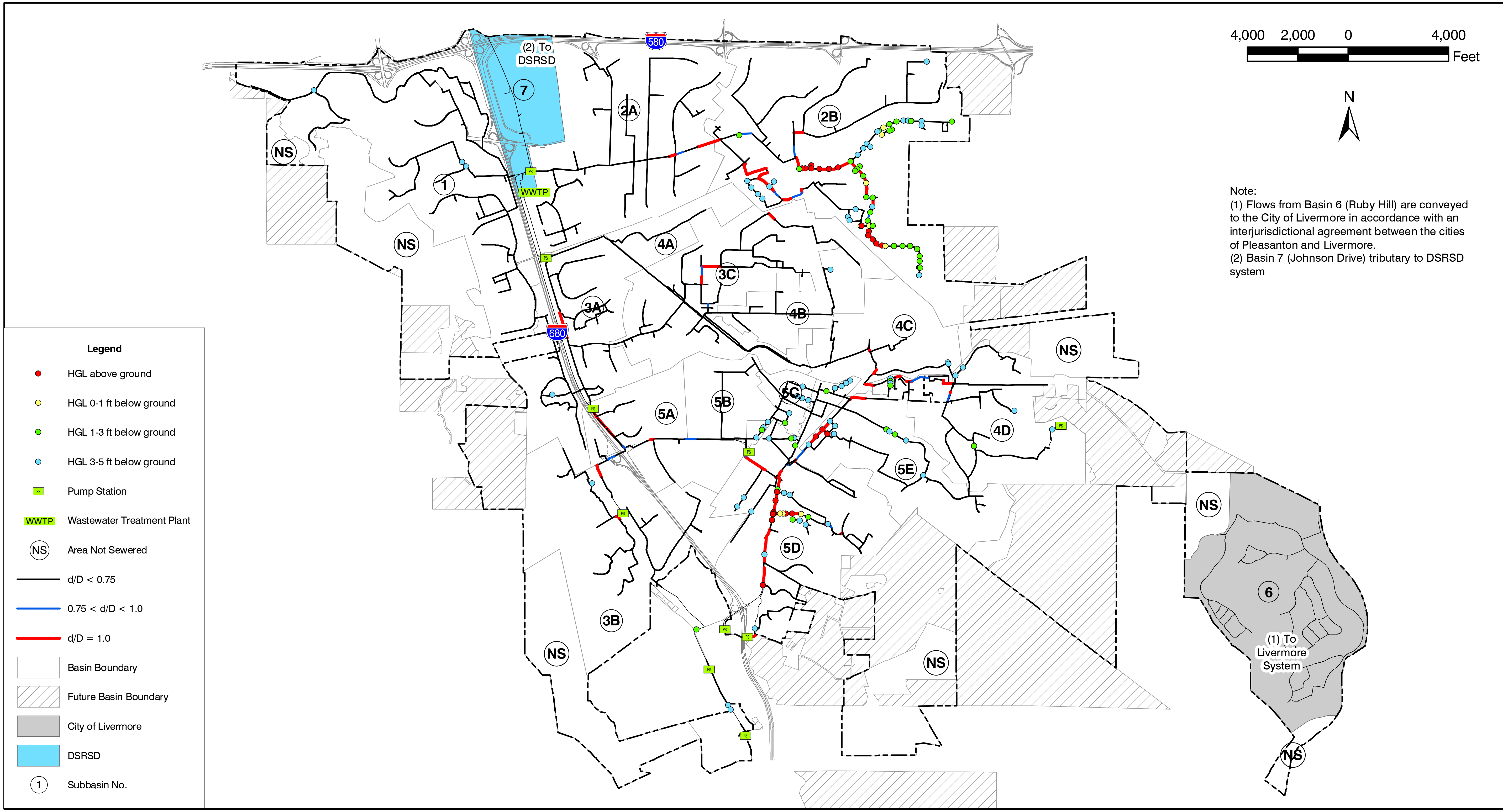

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Figure 6.5
CAPACITY ANALYSIS
FUTURE PWWF
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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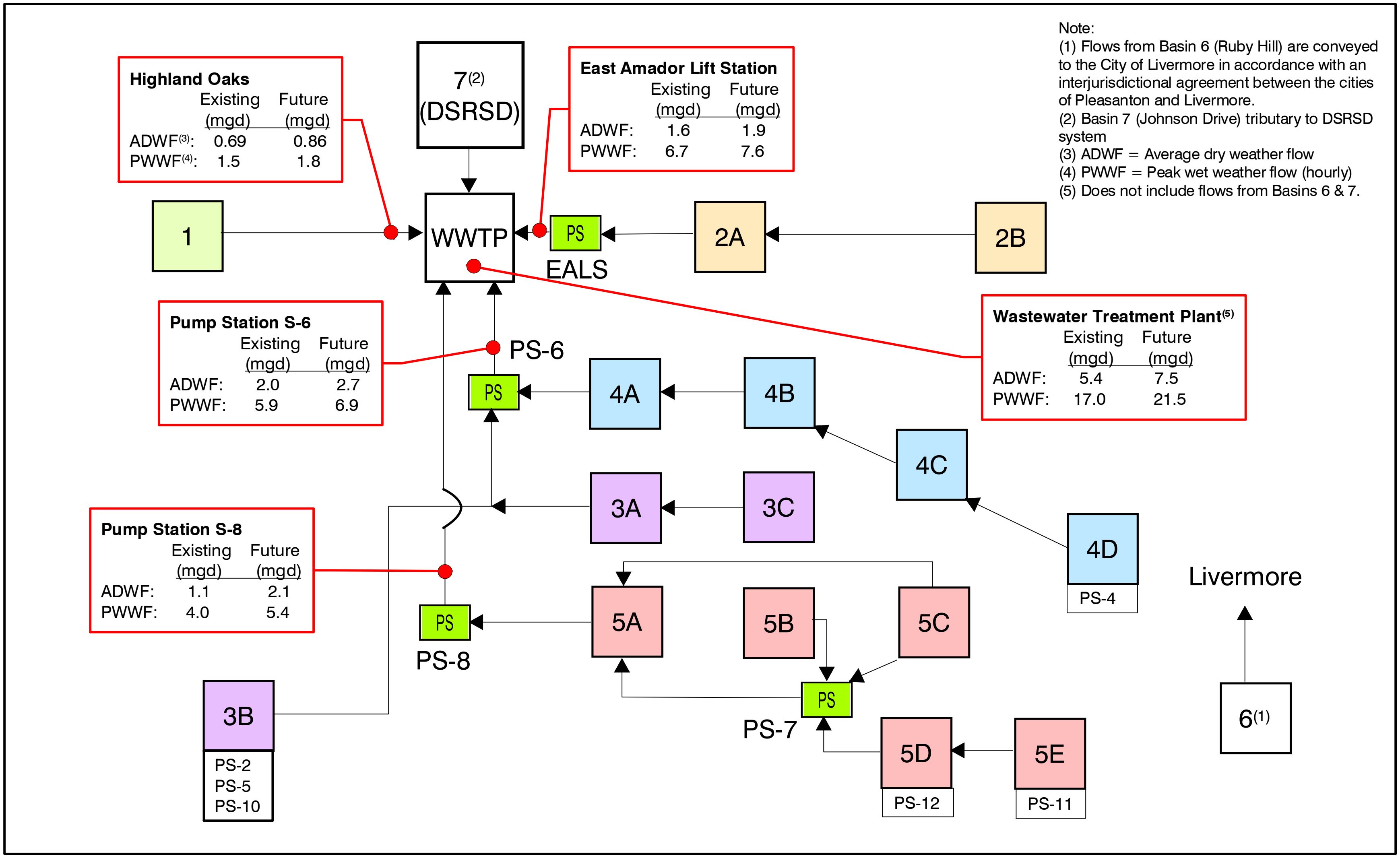

Figure 6.6
OUTFALL FLOWS
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

Table 6.2 Design Storm Comparison
Wastewater System Master Plan
City of Pleasanton

	Units	Existing Condition (Year 2003)	Future Condition[(1)]
Flow Type			
ADWF[(2)]	mgd[(3)]	5.35	7.52
Minimum DWF	mgd	2.08	3.05
PDWF[(4)]	mgd	8.41	11.6
Base Infiltration	mgd	1.41	1.41
PWWF[(5)]	mgd	17.0	21.5
Wet Weather Flow Pipeline Capacity			
d/D[(6)] < 0.75	---	2,018	1,972
0.75 < d/D < 1	---	6	28
d/D = 1	---	70	115
Wet Weather Flow Manhole Depth			
SSO[(7)]	---	4	29
< 1 ft below rim	---	3	10
1 - 3 ft below rim	---	29	43
3 - 5 feet below rim	---	71	73
> 5 ft below rim	---	1,917	1,887

Notes:
(1) Based on existing system with no improvements.
(2) ADWF = Average dry weather flow
(3) mgd = million gallons per day
(4) PDWF = Peak dry weather flow
(5) PWWF = Peak wet weather flow
(6) d/D = Depth to diameter flow ratio
(7) SSO = Sanitary sewer overflow

Under future flow conditions, five pump stations are deficient.

- EALS: PWWF 3.99 mgd over firm capacity.
- PS-6: PWWF 3.01 mgd over firm capacity.
- PS-8: PWWF 1.37 mgd over firm capacity.
- PS-7: PWWF 0.57 mgd over firm capacity.
- PS-12: PWWF 0.14 mgd over firm capacity.

Table 6.3 Pump Station Capacity Analysis Summary
Wastewater System Master Plan
City of Pleasanton

				Existing Flow (Year 2003)				Future Flow			
Pump Station I.D.	Description	Firm Capacity[1] (mgd)[2]	Total Capacity (mgd)	ADWF[3] (mgd)	PDWF[4] (mgd)	PWWF[5] (mgd)	Capacity Deficit[6] (mgd)	ADWF (mgd)	PDWF[4] (mgd)	PWWF[5] (mgd)	Capacity Deficit[6] (mgd)
PS-2	Oak Tree Farms	0.19	0.38	0.02	0.04	0.05	None	0.03	0.05	0.07	None
PS-4[7]	Valley Business Park	0.55	1.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PS-5	San Francisco	2.1	3.2	0.21	0.39	0.83	None	0.36	0.67	1.08	None
PS-6	Arroyo Mocho	3.9	5.9	2.03	3.26	5.90	2.01	2.66	4.20	6.90	3.0
PS-7	Bernal	4.0	6.1	0.87	1.36	3.15	None	1.88	2.82	4.60	0.6
PS-8	Bernal Business Park	4.0	6.1	1.06	1.58	4.03	None	2.08	2.95	5.40	1.4
PS-10	Castlewood	0.35	0.69	0.03	0.05	0.27	None	0.04	0.07	0.12	None
PS-11	Gray Fox	0.07	0.14	0.02	0.04	0.06	None	0.02	0.04	0.05	None
PS-12	Sunol	0.55	1.1	0.05	0.07	0.34	None	0.39	0.58	0.69	0.14
EALS	East Amador[8]	3.6	7.2	1.57	2.56	6.69	3.09	1.93	3.13	7.59	4.0

Notes:
(1) Firm capacity assumes largest pump is out of service.
(2) mgd = million gallons per day.
(3) ADWF = Average dry weather flow.
(4) PDWF = Peak dry weather flow (hourly).
(5) Peak hourly wet weather flow (10-year 24-hour design storm) (I/I + DWF).
(6) Capacity deficits are based on firm capacity and PWWF.
(7) Not modeled
(8) Operated by DSRSD

6.6 SUMMARY

Overall, the City's collection system has adequate capacity to convey DWFs. Few deficiencies exist under dry weather flow conditions. Capacity deficiencies under WWF conditions represent less than 10 percent of the modeled collection system. The relatively few number of deficiencies can be attributed to a well-designed system without significant I/I problems.

6.7 ADDITIONAL ANALYSIS

During the course of completing the master plan, the City requested several interim hydraulic analyses be performed to address development in the City. These analyses included BART/Stoneridge Mall and Staples Ranch developments. Details and results of these additional analyses are located in Appendix J.

REGULATORY ISSUES

7.1 INTRODUCTION

As new regulatory issues arise regarding the management, operation, and maintenance of sanitary sewer collection systems, the City of Pleasanton (City) should position itself to proactively address both current and future regulatory requirements. This chapter discusses the Sewer System Management Plan (SSMP) proposed by the California State Water Resources Control Board (SWRCB).

7.2 CMOM AND SSMP

The United States Environmental Protection Agency (EPA) is also developing regulations similar to California's SSMP. The EPA regulations are known as the Draft SSO Rule or more commonly known as Capacity, Management, Operation, and Maintenance (cMOM). Currently, the SSO rule is awaiting review by the Federal Office of Management and Budget (OMB) before being published in the Federal Register for public review and comment. Public comments will be incorporated into the final SSO rule for adoption, at which time cMOM requirements for sanitary sewer collection systems will become enforceable. It is unclear at this point in time when cMOM will be promulgated. However, due to delays in finalizing the cMOM regulations, the SWRCB has developed the SSMP to address SSO events at a sooner date. When the federal cMOM regulations are finally passed little if any additional compliance measures are anticipated since the state SSMP was crafted using cMOM as a guide.

7.3 PROPOSED SSMP

Municipal sanitary sewer collection systems with discharges to waters of the United States are required by the Clean Water Act of 1972 to have a National Pollutant Discharge Elimination System (NPDES) permit. In response to the increasing frequency of sanitary sewer overflows in the United States, the California SWRQB has developed the Sanitary Sewer Overflow Reduction Program (SSORP) focused on the capacity, management, operation, and maintenance of sanitary sewer collection systems. The SSORP is intended to be a proactive approach for reducing the public health and environmental impact of overflows, extending the life of sanitary sewer collection systems, and improving customer service.

The proposed SSORP will impact all current NPDES permit-holders, as well as owners of satellite sewer collection systems, by requiring them to develop and implement a SSMP. The SWRCB has provided an initial timeframe upon which to implement the SSMP. Phased implementation of the SSMP is anticipated in November 2005 with final completion in November 2007. The City must submit the SSMP to the Regional Water Quality Control

Board (RWQCB) for approval. A more detailed schedule will be released pending SWRCB adoption of final SSMP regulations.

After adoption of the SSORP, collection system owners and operators will be required to develop and implement a SSMP that will:

- Properly fund, manage, operate, and maintain their sanitary sewer collection systems.
- Provide adequate collection system capacity.
- Respond promptly and effectively to stop or mitigate SSO events.
- Notify affected parties of an SSO event.
- Make the SSMP and ongoing audits available to the general public.

The City can ease the impact of SSORP requirements by starting now to collect and organize SSMP information, taking steps to ensure adequate collection system capacity, and establishing a proactive operation and maintenance program.

To satisfy the regulatory requirements of the SSORP, communities will be required to develop a SSMP with four primary components:

- SSMP Summary.
- System Evaluation and Capacity Assurance Plan (SECAP).
- Overflow Emergency Response Plan.
- Ongoing SSMP program audits.

Each of the primary program components is discussed below.

7.3.1 SSMP Summary

The SSMP Summary is a general compilation of information about the management, operation, and maintenance of the City's sanitary sewer collection system. The SSMP Summary has eleven main components including:

1. Goals.
2. Organization.
3. Legal Authority.
4. Measures and Activities.
5. Design and Performance Provisions.
6. Monitoring, Measurement and Program Modifications.
7. Fats, Oils, and Grease (FOG) Control Program.

8. Communication.

9. System Evaluation and Capacity Assurance Plan (SECAP).

10. Overflow Emergency Response Plan.

11. SSMP Program Audits.

A description of each of the eleven components of the SSMP Summary is provided below. Since the last three items of the summary are part of the primary components, they will be discussed in detail below. Each will need to be addressed as separate sections in a written SSMP report. A summary of these three primary components will need to be included in an actual SSMP Summary document as well.

7.3.1.1 Program Goals

Program goals are an important aspect of the SSMP because they provide focus for City staff to continue or implement improvements in their management of the sanitary sewer collection system. The goals will determine the steps that must be taken to establish and define the purpose and anticipated results of the program. Goals should reflect performance, safety, customer service, resource use, compliance, and other considerations.

7.3.1.2 Organization

An organizational chart should be developed which identifies administrative and management positions responsible for implementing the SSMP. The organizational chart should also include operations and maintenance personnel that will be involved in developing and implementing the program. The employees involved with the SSMP should be provided with the necessary training required to perform their assigned SSMP duties.

A chain of communication for reporting SSO events will also be required. The chain of communication encompasses all those affected by the SSO event, including the initial receipt of a complaint to the notification of permitting authorities, other agencies, and the public.

7.3.1.3 Legal Authority

Sufficient legal authority must be provided to implement an effective SSMP. The proposed SSMP identifies five areas where legal authority is necessary for implementing an effective SSMP: (1) Controlling inflow and infiltration, (2) requiring sewers and connections to be properly designed and constructed, (3) ensure proper installation, testing, and inspection of new and rehabilitated sewers, (4) limit fats, greases, and other debris that may cause blockages in the collection system, and (5) implementing the general and specific prohibitions of the national pretreatment program under 40 CFR 403.5.

Legal authority can be provided through sewer use ordinances, service agreements, discharge permits, or other legally binding documents.

7.3.1.4 Measures and Activities

Measures and activities specified for implementation as part of a SSMP should be tailored to the size, complexity, and specific features of the City's collection system. The SSMP Summary should include the eleven measures and activities outlined below, and identify the person or position in the organization responsible for each of these measures and activities. The eleven measures and activities are:

1. Maintenance of Facilities and Equipment

   The City should allocate adequate resources to the operation and maintenance of its collection system facilities and equipment. These resources include budget, staff, equipment, tools, consumables, contract services, and spare or repair parts. It also includes resources for planning, design, construction, and inspection of new or rehabilitated facilities.

2. Maintenance of a Collection System Map

   A knowledge of the location of all sanitary sewer collection system facilities is essential to effective management. This requires the maintenance of up-to-date collection system maps, either in hard copy or electronic format. Information that should be included on sewer maps include facility location, unique facility identifier, pipe size, pipe length, direction of flow and pipe material. Additional information can include installation date, rim elevation, invert elevation (or depth to invert), and the design/construction document reference number. The section should describe the type of maps currently being used, along with procedures for updating the maps with new and rehabilitated facilities.

3. Management and Use of Information to Establish and Prioritize SSMP Activities

   Describe the City's information management systems used for tracking all SSMP related information, including maintenance, rehabilitation, and emergency calls. This information should also include identifying SSO events and analyzing the trends of SSO events. A dynamic SSMP should focus on approaches for planning, implementing, reviewing, evaluating, and taking appropriate actions in response to available information.

4. Routine Preventive, Operation and Maintenance Activities

   Describe routine preventive operation and maintenance activities. A good preventive maintenance program is one of the best ways to keep a system in good repair and to prevent service interruptions and system failures that can result in overflows or back-ups. This section should include a description of the extent and frequency of operations and maintenance activities such as inspections, sewer cleaning, and pump station maintenance. The staffing and equipment required to support these activities should be consistent with the allocation of resources in paragraph 1.

5. Collection System Capacity Program

Establish a program to assess the capacity of the collection system. The program shall include diversions of urban runoff to the sewer system during dry weather periods and control of inflow and infiltration (I/I) during both dry and wet weather periods. A brief description of this activity must be included in the SSMP Summary. However, a detailed Sewer Evaluation and Capacity Assurance Plan must be developed and is discussed later in Section 7.3.2.

6. Structural Deficiencies

The City should identify and prioritize structural deficiencies and implement short-term and long term actions to address them. Periodic condition assessment should be performed for each sewer line segment to determine the extent and location of problem areas.

7. Appropriate Training on a Regular Basis

Develop a training program for inspectors, operators, and maintenance personnel. An on-going training program should address the skills necessary to perform proper operations and maintenance, to provide timely and effective emergency response, incorporate recognized safety practices, and other training to ensure City collection system staff are adequately prepared to implement provisions of the SSMP.

8. General and Critical Equipment and Replacement Parts Inventory

Prepare an inventory of equipment and replacement parts and a list of critical parts needed for collection system operation. Maintain an adequate replacement parts inventory, and provide proper storage facilities for these parts. The process for identifying critical parts should be based on a review of existing equipment and manufacturers' recommendations, supplemented by the experience of City collection system staff. The quantity and type of replacement parts will depend on size, age, operation, and condition of the sewer collection system.

9. Fats and Grease Public Education Program

Establish a site-specific implementation plan and schedule for a public education outreach program that promotes proper disposal of fats, oil, and grease for all service connections. A brief description of this activity must be included in the SSMP Summary. However, the public education program must also be included as part of the more comprehensive Fats, Oils, and Grease Control Program, discussed later in Section 7.3.1.7.

10. SSO Response and Prevention Plan

Establish a plan in accordance with the local County's Drainage Area Management Plan to (1) respond to SSOs from private property onto public right-of-ways (ROW) and storm drains and (2) prevent discharges from SSOs to surface waters and storm drains. A brief description of this activity must be included in the SSMP Summary. However, a detailed SSO response and prevention plan must be developed and is discussed later in Section 7.3.3.

11. Alternate Disposal of Fats and Grease

Develop a plan and schedule for providing an analysis of alternative methods of disposal for fats and grease. The plan shall include an evaluation of the feasibility of using sludge digesters at the wastewater treatment plant (WWTP) for grease disposal and treatment, recycling, rendering, and other disposal alternatives. A brief description of this activity must be included in the SSMP Summary and must also be included as part of the more comprehensive Fats, Oils, and Grease Control Program, discussed later in Section 7.3.1.7.

7.3.1.5 Design and Performance Provisions

The City should identify minimum design and construction standards and specification for the installation of new sewer systems and for the rehabilitation and repair of existing sewer systems. An effective program that ensures that new sewers are properly designed and installed can minimize system deficiencies that could create or contribute to future overflows or operations and maintenance problems. The City should establish specific design criteria and construction standards for new construction and for rehabilitation. Design criteria should include specifications such as pipe materials, minimum sizes, minimum cover, strength, minimum slope, trench and backfill, structure standards, and other factors as necessary.

The City should also identify procedures and standards for inspecting and testing the installation of new sewers, pump stations, and other facilities, as well as rehabilitation and repair projects.

7.3.1.6 Monitoring, Measurement, and Program Modifications

The City shall monitor the effectiveness of each SSMP element and update and modify program elements to keep them accurate, and available for audit, as appropriate. Activities and methods to be used in assessing the effectiveness of the SSMP should be specified. The effectiveness of the program should be measured by developing and tracking performance indicators on a regular basis. The performance indicators should be in concert with the Program Goals section of the program. Specific program elements should be modified as appropriate based upon performance evaluations. Resulting program modifications should be summarized and included in ongoing audits and the SSMP Summary.

7.3.1.7 Fats, Oils, and Grease (FOG) Control Program

Develop and implement a FOG source control program that reduces the amount of these substances in the collection system. The goals of the program should be to identify FOG trouble spots in the collection system, establish a cleaning schedule, and develop and implement source control measures. The program shall include legal authority to prohibit discharges to the system and measures to prevent SSOs caused by FOG blockages in sewers. An effective FOG control program may include the following elements: (1) requirements to install grease removal devices, (2) design standards for removal devices, (3) maintenance requirements, (4) Best Management Practices (BMP), (5) record keeping, (6) reporting requirements, (7) inspection and enforcement authority, and (8) sufficient personnel to inspect and enforce program.

7.3.1.8 Communication

Communication is essential to ensuring that collection system runs efficiently and effectively. Procedures should be in-place for both internal and external communication. External communication may consist of public outreach and education forums.

7.3.2 System Evaluation and Capacity Assurance Plan (SECAP)

The SECAP includes three components: a collection system evaluation, recommended improvements for capacity assurance, and regularly scheduled updates. Many essential elements of the SECAP are addressed as part of the development of this sanitary sewer collection system master plan update. Typically, a master plan will fulfill two of the three SECAP requirements. The remaining component, scheduling regular SECAP updates, will need to be addressed. The three components are described below.

7.3.2.1 Evaluation

Evaluation of a sanitary sewer collection system should include a summary of steps planned or undertaken to identify and characterize hydraulic deficiencies contributing to SSOs. The scope of evaluation for each identified deficiency will vary depending on it’s cause, nature, complexity, and severity.

The system evaluation must provide estimates of peak flows (including flows from SSOs that escape from the system), provide capacity estimates for key system components, identify hydraulic deficiencies, identify components of the system with limiting capacity, and identify the major sources of I/I contributing to SSO events. The evaluation should also include recommended remedial actions to address system deficiencies.

7.3.2.2 Capacity Enhancement Measures

Capacity assurance is the process of developing solutions to address hydraulic deficiencies identified during the sanitary sewer collection system evaluation. The City would be required to implement a program to assess the current capacity of the collection system and treatment facilities that they own or have operational control (i.e., satellite collection systems).

Capacity enhancement measures should establish short and long term actions to correct each identified hydraulic deficiency contributing to SSOs. Short and long term actions for each hydraulic deficiency should include alternative analyses, a prioritization of recommended projects, and an implementation schedule. The capital improvement plan should be coordinated with the identification and prioritization of structural deficiencies identified in the Measures and Activities section of the SSMP.

7.3.2.3 Plan Updates

Updates to the SECAP should be completed on a regularly scheduled (at minimum annually) basis to describe any significant change in proposed actions and/or implementation schedule. The SECAP should also be updated to reflect available information on the performance of implemented measures. The City's hydraulic model, used to identify capacity deficiencies, should be maintained on a continuous basis or updated on the same regularly scheduled basis as the SECAP update.

7.3.3 Overflow Emergency Response Plan

An Overflow Emergency Response Plan (OERP) provides a standardized course of action to be followed by collection system personnel during an SSO event. An up-to-date OERP is necessary to ensure that a municipality is adequately prepared to respond to an SSO event. The OERP should describe protocols for the response, remediation, and notification of an SSO event under varying scenarios.

The OERP should identify measures to protect the public health and the environment for a broad range of potential collection system failures that could lead to an SSO. At a minimum, the OERP should ensure:

1. Identification of all SSOs.
2. Immediate response, emergency operations, and submittal of reports to appropriate personnel for investigation.
3. Appropriate notification and reporting to the public, health officials, NPDES authority, and other affected entities.
4. Personnel are properly trained in responding to an SSO event.
5. Effective organization of emergency operations during an SSO event.

7.3.4 SSMP Program Audits

Ongoing audits are required to demonstrate SSMP effectiveness to the Regional Board. The SSMP audit should include a discussion of SSMP compliance with permit requirements, identified SSMP deficiencies, and necessary corrective measures. The audit should include details on the size of collection system facilities, as well as the quantity and severity of any SSO events that have occurred.

7.4 SSMP PROGRAM IMPLEMENTATION

The City completed the SSMP Initial Audit forms in the Spring of 2005. After completing the initial audit, a SSMP Gap Analysis was conducted to assess if further system management, operation, and maintenance activities should be included in the City's programs that are currently in-place. As part of the GAP Analysis, a checklist of program elements was prepared. This checklist identifies which program elements the City (1) has in-place, (2) is in the process of developing, or (3) will need to develop, if the proposed regulations, as they are written, are promulgated.

An initial audit form and collection system performance assessment form were filled out by City Staff as part of this project. These completed forms are provided in Appendix K.

The City has done an excellent job maintaining and operating their collection system. On going operation and maintenance activities are a priority for collection system staff. After reviewing the initial audit and collection system performance assessment forms, a checklist was developed for overall SSMP element compliance. The checklist is presented in Table 7.1 and illustrates the programs that the City currently has in-place (or are on-going), programs that are currently being developed (or in-progress), and programs that the City does not currently have but are required for SSMP compliance.

The City has many of the SSMP elements either in-place or these programs are currently being developed. However, a few program elements have been identified that the City may need to develop for compliance with the pending SSO regulations. These program elements are:

1. Program Goals – the City needs to establish program goals. The program goals will establish and define the purpose and anticipated results of the SSMP.

2. Wastewater Quality Monitoring Program – the City is currently not obligated to perform wastewater quality monitoring on their collection system or overflow events. If this changes in the future, the City will be required to implement a wastewater quality-monitoring program.

3. Flow Monitoring Program – the City does not currently have a formalized flow-monitoring program. However, the City does conduct temporary flow monitoring as part.

Table 7.1 SSMP Checklist
Wastewater System Master Plan
City of Pleasanton

Program Element	Completed or On-going Program in Place	Program In-Progress	Program Needed
1. Management(1)			
a. Program Goals			X
b. Organizational Structure	X		
c. Formal Training Program	X		
d. Communication	X		
e. Customer Service	X		
f. Management Information Systems	X		
g. SSO Notification Programs	X		
h. Legal Authority	X		
2. Operation(1)			
a. Operational Budgeting	X		
b. Compliance	X		
c. Water Quality Monitoring			N/R(2)
d. Hydrogen Sulfide Monitoring & Control	X		
e. Safety	X		
f. Emergency Preparedness & Response	X		
g. Modeling	X		
h. Engineering	X		
i. Pump Stations	X		
3. Maintenance(1)			
a. Maintenance Budgeting	X		
b. Maintenance Activities	X		
c. Sewer Cleaning			X
d. Parts & Equipment Inventory	X		
e. Flow Monitoring(3)	X		
f. Manhole & Pipeline Inspection			X
g. Smoke Testing, Building Inspections & Dyed Water Testing	X		
h. Closed Circuit Televised Inspection	X		
i. Rehabilitation	X		
4. System Evaluation & Capacity Assurance Plan	X		
5. Overflow Emergency Response Plan	X		
6. SSMP Audit Forms(4)	X		

Notes:
(1) The Management, Operation and Maintenance elements encompass the SSMP Summary.
(2) Water Quality Monitoring is currently not required.
(3) Flow Monitoring performed as part of Sewer System Master Plan.
(4) The City has completed the initial audit form which is provided in Appendix K.

of their collection system master plan updates, and also has a permanent flow meter on the influent lines at the WWTP.

4. Manhole and Pipeline Inspection – the City does not currently have a manhole inspection program. However, pipelines are inspected via Closed Circuit Television (CCTV).

7.4.1 SSMP Schedule

The RWQCB has developed a schedule to assist agencies in complying the SSMP Regulations. Table 7.2 presents the compliance schedule for the City.

**Table 7.2 SSMP Compliance Schedule
Wastewater System Master Plan
City of Pleasanton**

SSMP Element	Completion Date
Goals Organization Overflow Emergency Response Plan	August 31, 2006
Fats, Oils, and Grease (FOG) Control Program Legal Authority Measures and Activities Design and Construction Standards	August 31, 2007
Capacity Management Monitoring, Measurement, and Program Modifications SSMP Audits	August 31, 2008

CAPITAL IMPROVEMENT PROGRAM

8.1 INTRODUCTION

The capacity analysis, described in Chapter 6, sets the foundation for the Capital Improvement Program (CIP), which focuses on alleviating the collection system capacity deficiencies. The CIP will serve as a working document which will provide the City of Pleasanton (City) a structured plan to update the sewer collection system. The criteria used to develop the CIP are discussed in this chapter along with a phasing of improvements.

8.2 CAPITAL IMPROVEMENT PROGRAM

The City currently operates and maintains a relatively new sewer collection system that was primarily constructed after 1970. However, parts of the collection system were constructed in the 1950s and 1960s and is nearing the end of their useful life. The City should consider rehabilitation and capital improvements within their entire service area to address capacity deficiencies and plan for future growth. The CIP provides the City with a working document that will correct the capacity deficiencies in the collection system in order to convey the peak wet weather flows (PWWF) to the wastewater treatment plant (WWTP). When fully implemented, the CIP will provide hydraulic capacity to convey PWWFs during the 10-year 24-hour design storm for the projected build-out condition. This section provides a discussion of the sewer replacement criteria, modeling assumptions, cost criteria and the recommended pipeline improvements.

8.2.1 CIP Criteria

8.2.1.1 <u>Modeling and Analysis Assumptions</u>

The CIP is based on several assumptions:

- The hydraulic grade line is to be maintained a minimum of one foot below ground level during the 10-year, 24-hour design storm's PWWF.
- United States Geological Survey (USGS) Digital Elevation Models (DEM) were used to interpolate where ground elevations were unknown. Should pipeline improvements be required where ground elevations are unknown, field verification of the ground elevation is recommended during the predesign effort.
- The hydraulic model evaluated primarily the 10-inch and greater diameter pipelines. Analysis of the City's 6-inch and 8-inch diameter pipelines was not part of the scope of services for this wastewater system master plan. No analysis was performed to determine if flooding would occur in these pipelines when the larger pipelines are surcharged to within one foot of rim elevation.

8.2.1.2 Sewer Replacement Criteria

When additional capacity is required, existing sewers can be replaced or paralleled. For the purposes of this master plan update, it is assumed that an existing deficient sewer will be replaced with a larger diameter pipeline at the same slope as the existing pipeline. The decision to replace or parallel the existing pipeline should be made during the predesign effort. During the predesign effort, the existing sewer should be closed circuit televised (CCTV) to determine its structural condition. If deteriorated, the existing sewer could either be replaced or rehabilitated by slip lining or inversion lining and a parallel sewer be constructed to convey the excess flow. A rehabilitated sewer has less hydraulic capacity because of a reduction in cross-sectional area and this loss in existing capacity needs to be accounted for when sizing the parallel sewer.

8.2.1.3 Cost Criteria

The construction cost estimate used in developing the CIP is based upon the unit costs presented in Table 8.1. These costs are based on planning level estimates for similar communities in the San Francisco Bay Area. The unit costs are for “typical” field conditions with construction in stable soil at an average depth of 15 feet. High seasonal groundwater could greatly affect the overall unit cost. The unit costs include pipe purchase and installation, manhole and appurtenances, excavation and backfill, pavement removal and replacement, limited sheeting, dewatering and shoring, and contractor overhead and profit. The costs are based on an Engineering News Record Construction Cost Index (ENR CCI) of 9,063 (San Francisco, June 2007). To develop total CIP project costs, an additional 30 percent is added for construction contingencies and 35 percent is added for engineering, administrative and legal fees. These contingencies are the same as those used in the City’s recently completed water master plan, and are similar to those used by other agencies.

8.2.2 FLOW ROUTING ALTERNATIVES

Several flow routing alternatives were studied and their potential cost/benefits analyzed. The routing alternatives involved transferring flow between existing basins using major facilities of the collection system (e.g. Cross-Town Interceptor, EARS line, and Pump Station S-8). The four routing alternatives investigated are described below.

- Alternative 1A studied routing Basin 4D by gravity to the Cross-Town Interceptor. This alternative is approximately 20 percent more expensive than the recommended CIP.
- Alternative 1B investigated routing all flows tributary to Pump Station S-7 to the Cross-Town Interceptor via a new force main. This alternative is approximately 40 percent more expensive than the recommended CIP.
- Alternative 2 studied the transfer of flow from Basin 3B to Pump Station S-8, via a new pump station. This alternative is approximately 40 percent more expensive than the recommended CIP.

Table 8.1 Pipeline Unit Costs Wastewater System Master Plan City of Pleasanton				
			Construction Cost	Capital Improvement Cost
Pipe Diameter (inches)	Trench Depth (feet)	Unit Cost(1) ($/LF)	Unit Cost + 30% Construction Contingency ($/LF)	Construction Cost 35% Other Costs ($/LF)
Gravity Main				
8	15	168	218	294
10	15	188	245	330
12	15	204	266	358
15	15	215	279	377
18	15	229	298	402
24	15	284	369	498
27	15	302	393	530
30	15	355	461	623

Notes:
(1) Unit costs include pipe and pipe installation, manhole and appurtenances, lower laterals, excavation and backfill, pavement removal and replacement, limited sheeting, dewatering and shoring, and contractor overhead and profit.
(2) These costs coincide with an ENR of 9,063 for San Francisco (June 2007).

- Alternative 3 investigated the activation of the EARS line. Flow from portions of Basin 2B would be transferred and conveyed in the EATS line. At the termination point downstream, a new lift station and gravity sewer would be required. Alternative 3 is approximately 5 percent more expensive than the recommended CIP.

The routing alternatives investigated had total CIP costs that varied between 5 to 40 percent higher than the recommended CIP. During a workshop with City staff the routing alternatives were presented. The decision was made to implement Alternative 3 in the recommended CIP. Since the existing EALS is under capacity and in need of improvements, replacing it with an EARS pump station makes Alternative 3 feasible without being prohibitively more expensive. The City also envisions increased growth tributary to the EATS line, increasing the attractiveness of Alternative 3.

8.2.3 Recommended Capital Improvement Program

City staff selected to improve the collection system to convey the PWWFs of the 10-year 24-hour design storm. The pipe criteria set for this alternative was to pass the PWWFs while allowing the surcharge level to rise up to one foot below the manhole rim elevation. A number of pipelines require improvements to meet the City's surcharge criteria. The recommended CIP includes several pipeline improvements and capacity upgrades at several pump stations. The recommended CIP is summarized below:

Several pipeline conveyance improvements are required to improve the capacity of the collection system. The pipeline conveyance improvements range in diameter from 6-inch to 30-inch and involve the replacement of approximately 16,100 feet.

The CIP construction and total project costs are summarized in Table 8.2 and total $17,867,000. Pipelines are estimated to cost $10,854,000 and pump stations are estimated to cost $7,013,000. The total project costs include a 30 percent construction contingency and a 35 percent engineering, administrative and legal contingency. The improvements are based on DWF projected to the build-out condition, in conjunction with the WWF of the 10-year, 24-hour design storm.

8.3 CIP PHASING

Prioritizing the required capital improvements for the City sewer collection system is an important aspect of the CIP. The CIP needs to be phased in a manner that provides the City with an economical and realistic approach to implementing the CIP. The recommended improvements were separated into 15 projects. These 12 projects were prioritized based on four factors: (1) capacity deficiency, (2) historical overflow problems (if any), (3) sufficient downstream conveyance capacity, and (4) annualized cost. The result of the prioritization was to group the 12 projects into three CIP phases, each of which can be designed and constructed within one to three years. The three phases and their projects are presented in Figure 8.1. The expenditure, per phase, for the City would range from $2,238,000 to $10,944,000. A detailed list of pipeline improvements for each of the three phases is provided in Appendix L.

8.3.1 Phase 1 Projects (Near-Term)

Phase 1 consists of five near-term projects totaling an estimated $10,944,000. The five projects are:

8.3.1.1 <u>Project 1A: Santa Rita Road Sewer</u>

Project 1A consists of replacing 522 feet of pipeline upstream of the dual 8-inch siphons crossing the Arroyo Mocho Canal. The existing 10 and 12-inch pipelines should be replaced with a 15-inch pipeline. Project 1A is estimated to cost $185,000.

8.3.1.2 <u>Project 1B: First Street Sewer</u>

Project 1B consists of replacing 2,120 feet of pipeline along First Street from Bernal Avenue to Arendt Way. The existing 6 and 10-inch pipelines should be replaced with a 12-inch pipeline. in two reaches. Reach 1 involves replacing 204 feet of existing 10-inch pipeline along Sunol Boulevard between Monaco Drive and Bernal Avenue with a new 12-inch pipeline. Reach 2 involves replacing 2,123 feet of existing 6-inch and 10-inch pipeline along

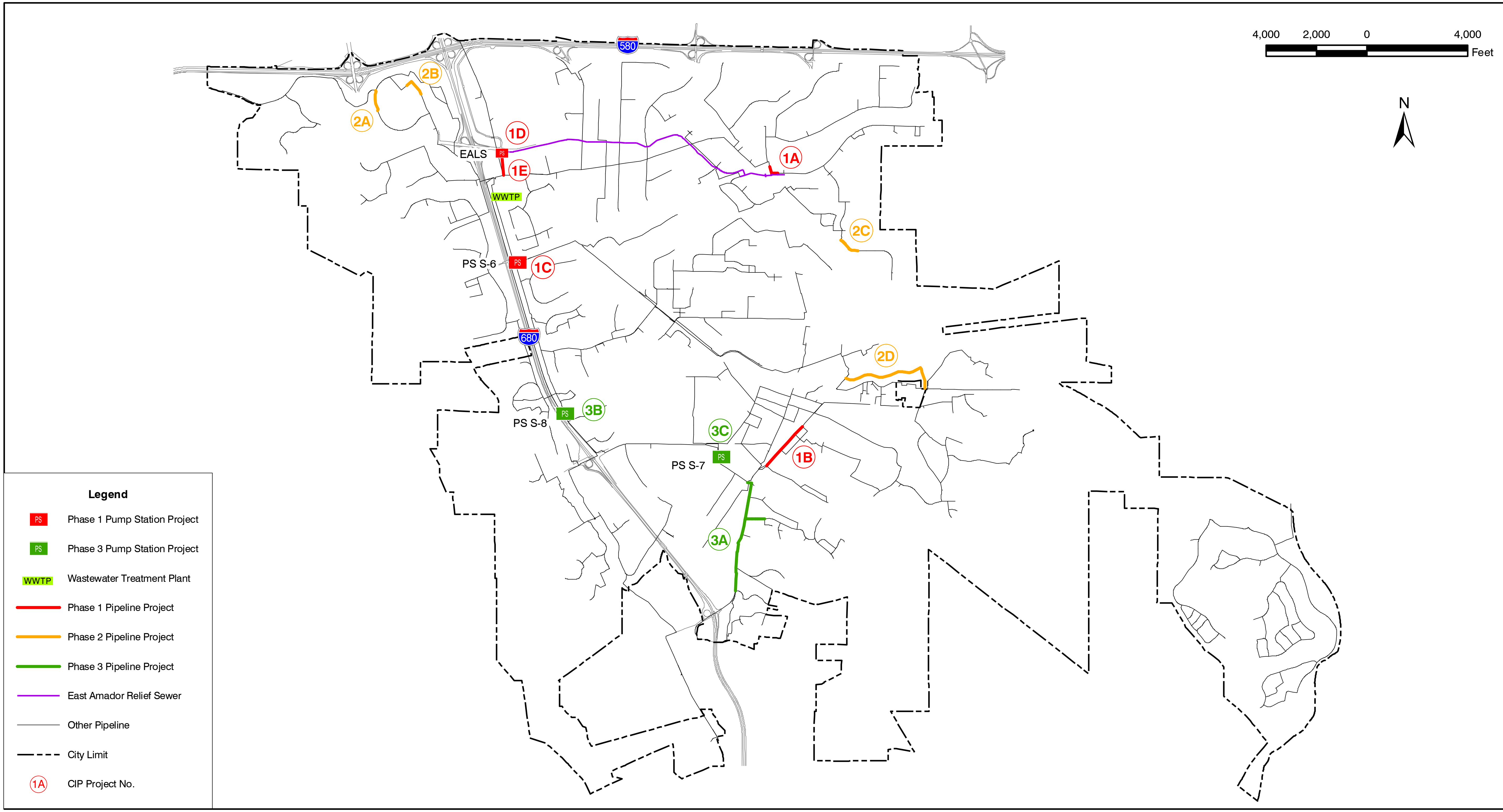

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Figure 8.1
RECOMMENDED CAPITAL IMPROVEMENT PROGRAM
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 18, 2007

Table 8.2 Capital Improvement Program Costs
Wastewater System Master Plan
City of Pleasanton

Project	Description	Project Type	Diameter (Inches)	Quantity	Units	Estimated Direct Construction Cost ($)	Construction Contingency[1] ($)	Admin/Legal/ Construction/ Engineering Contingency[2] ($)	Estimated Total Project Cost[3] ($)	2003 Dry Weather Flow (MGD)	Future Dry Weather Flow (MGD)	2003 DUE[4] (DUE)	Future DUE (DUE)	DUE Increase (DUE)	Percent Existing Customers (%)	Percent Future Customers (%)	Estimated CIP Cost Existing Customers (%)	Estimated CIP Cost Future Customers (%)
Phase 1 - Near-Term																		
1A	Santa Rita Road Sewer	Pipeline	15	522	LF	$ 112,000	$ 34,000	$ 39,000	$ 185,000	0.2	0.4	843	1,633	790	51.6%	48.4%	$ 96,000	$ 89,000
1B	First Street Sewer	Pipeline	12	2,120	LF	$ 433,000	$ 130,000	$ 152,000	$ 715,000	0.4	0.5	1,820	2,067	247	88.1%	11.9%	$ 630,000	$ 85,000
1C	Rebuid PS S-6	Pump Station	---	6.9	MGD	$ 2,500,000	$ 750,000	$ 875,000	$ 4,125,000	2.0	2.7	9,233	12,091	2,858	76.4%	23.6%	$ 3,150,000	$ 975,000
1D	EARS PS	Pump Station	---	7.6	MGD	$ 3,000,000	$ 900,000	$ 1,050,000	$ 4,950,000	1.6	1.9	7,149	8,778	1,629	81.4%	18.6%	$ 4,031,000	$ 919,000
1E	EARS Connector Sewer	Pipeline	18&30	1,600	LF	$ 587,000	$ 177,000	$ 205,000	$ 969,000	1.6	1.9	7,149	8,778	1,629	81.4%	18.6%	$ 789,000	$ 180,000
Phase 1 Total						**$ 6,632,000**	**$ 1,991,000**	**$ 2,321,000**	**$ 10,944,000**								**$ 8,696,000**	**$ 2,248,000**
Phase 2 - Medium-Term																		
2A	Stoneridge Mall Bypass	Pipeline	8	850	LF	$ 143,000	$ 43,000	$ 50,000	$ 236,000	0.1	0.2	537	861	325	62.3%	37.7%	$ 147,000	$ 89,000
2B	Nordstrom Sewer	Pipeline	8	860	LF	$ 144,000	$ 43,000	$ 50,000	$ 237,000	0.1	0.1	446	624	178	71.4%	28.6%	$ 169,000	$ 68,000
2C	Kamp Drive Sewer	Pipeline	10	855	LF	$ 161,000	$ 48,000	$ 56,000	$ 265,000	0.0	0.2	84	799	716	10.4%	89.6%	$ 28,000	$ 237,000
2D	Vineyard Sewer	Pipeline	18	3,972	LF	$ 909,000	$ 273,000	$ 318,000	$ 1,500,000	0.3	0.5	1,457	2,056	599	70.9%	29.1%	$ 1,063,000	$ 437,000
Phase 2 Total						**$ 1,357,000**	**$ 407,000**	**$ 474,000**	**$ 2,238,000**								**$ 1,407,000**	**$ 831,000**
Phase 3 - Long-Term																		
3A	Sunol Boulevard Sewer	Pipeline	12	5,333	LF	$ 1,089,000	$ 327,000	$ 381,000	$ 1,797,000	0.3	1.2	1,458	5,309	3,851	27.5%	72.5%	$ 493,000	$ 1,304,000
3B	Upgrade PS S-8	Pump Station	---	5.4	MGD	$ 1,000,000	$ 300,000	$ 350,000	$ 1,650,000	1.1	2.1	4,841	9,459	4,618	51.2%	48.8%	$ 844,000	$ 806,000
3C	Upgrade PS S-7	Pump Station	---	4.6	MGD	$ 750,000	$ 225,000	$ 263,000	$ 1,238,000	0.9	1.9	3,971	8,551	4,580	46.4%	53.6%	$ 575,000	$ 663,000
Phase 3 Total						**$ 2,839,000**	**$ 852,000**	**$ 994,000**	**$ 4,685,000**								**$ 1,912,000**	**$ 2,773,000**
Total						**$ 10,828,000**	**$ 3,250,000**	**$ 3,789,000**	**$ 17,867,000**								**$ 12,015,000**	**$ 5,852,000**

Notes:
(1) Construction Contingency = 30 percent of Direct Construction Cost
(2) Admin/Legal/Construction/Engineering Contingency = 35 percent of Direct Construction Cost
(3) Total Project Cost based on San Francisco ENR = 9,063 (June 2007)
(4) DUE = Dwelling Unit Equivalent = 220 gal/day

First Street between Bernal Avenue and Arendt Way with a new 12-inch pipeline. Project 1B is estimated to cost $715,000.

8.3.1.3 Project 1C: Rebuild PS S-6

PS-6 is an old pump station with capacity problems under dry weather flow conditions. A recent site inspection revealed the existing structure to be in poor condition. Pump Station S-6 is currently at capacity and should be upgraded from 4.0 mgd to an 6.9 mgd pump station. The existing facility cannot accommodate this upgrade. The existing building, wet well, and dry well are all too small to accommodate the new equipment. In order to increase the capacity at this station it is recommended that a new facility be constructed adjacent to the existing pump station. Construction for this project is estimated to take a year and during that time the existing pump station would remain in service. Project 1C is estimated to cost $4,125,000.

8.3.1.4 Project 1D: EARS PS

Project 1D involves the construction of a new EARS pump station. In conjunction with Project 1E, the improvements will results in the activation of the EARS line. The new EARS PS will replace the existing EALS which is under capacity. It is recommended that the new pump station have a firm capacity of 7.6 mgd. Project 1D is estimated to cost $4,950,000.

8.3.1.5 Project 1E: EARS Connector Sewer

Project 1E will connect the new EARS PS (Project 1D) with the existing system. An 800-foot, 30-inch diameter gravity pipeline will convey flows from the existing EALS to the new EARS PS. In addition, an 800-foot, 18-inch forcemain from the EARS PS will then carry the flow back to the existing manhole where flows will continue by gravity to the WWTP. Project 1E is estimated to cost $969,000.

8.3.2 Phase 2 Projects (Medium-Term)

Phase 2 consists of four medium-term projects totaling an estimated $2,238,000. The four projects are:

8.3.2.1 Project 2A: Stoneridge Mall Bypass

Project 2A consists of a new 850-foot, 8-inch pipeline that will bypass the existing Stoneridge Mall sewer. The new pipeline will be constructed along the eastern portion of Stoneridge Mall Road from Canyon Way to near Deodar Way. Project 2A is estimated to cost $236,000.

8.3.2.2 Project 2B: Nordstrom Sewer

Project 2B consists of re-routing an existing 8-inch pipeline to accommodate a Nordstrom expansion at Stoneridge Mall. The existing pipeline alignment is just outside the current mall building. The proposed new 8-inch pipeline alignment will extend further east, almost to Stoneridge Mall Road. Project 2B is estimated to cost $237,000.

8.3.2.3 Project 2C: Kamp Drive Sewer

Project 2C consists of replacing 855 feet of existing 8-inch pipeline along Kamp Drive between Maple Leaf Drive and Begonia Court with a new 10-inch pipeline. This reach of pipeline is not capacity limited. However, upstream and downstream reaches are 10-inch pipelines. Replacing the 8-inch pipeline will result in better maintenance of the line. Project 2C is estimated to cost $265,000.

8.3.2.4 Project 2D: Vineyard Sewer

Project 2D is a resulting project from the Vineyard Sewer Master Plan. A new 3,972-foot, 18-inch pipeline will be constructed to provide relief in the Vineyard area. The pipeline is proposed from Bernal and Vineyard Avenues to Nevada Street and along Nevada Street to First Street near Downtown. Project 2D is estimated to cost $1,500,000.

8.3.3 Phase 3 Projects (Long-Term)

Phase 3 consists of three long-term projects totaling an estimated $4,685,000. The three projects are:

8.3.3.1 Project 3A: Sunol Boulevard Sewer

Project 3A consists of replacing 5,333 feet of pipeline along Sunol Boulevard in three reaches. Reach 1 involves replacing 3,031 feet of existing 8-inch and 10-inch pipeline along Sunol Boulevard from Arlington Drive to Junipero Street with a new 12-inch pipeline. Reach 2 involves replacing 1,522 feet of existing 10-inch and 12-inch pipeline along Sunol Boulevard from Junipero Street to Monaco Drive with a new 15-inch pipeline. Reach 3 involves replacing 780 feet of existing 8-inch pipeline along Junipero Street between Sunol Boulevard and Sonoma Drive with a new 12-inch pipeline. The pipeline improvements are needed for future development upstream. Project 3A is estimated to cost $1,797,000.

8.3.3.2 Project 3B: Upgrade PS S-8

Upgrade Pump Station S-8 from a firm capacity of 4.0 mgd to 5.4 mgd. The upgrades are needed to accommodate future development in upstream basins. Project 3B is estimated to cost $1,650,000.

8.3.3.3 Project 3C: Upgrade PS S-7

Upgrade Pump Station S-7 from a firm capacity of 4.0 mgd to 4.6 mgd. The upgrades are needed to accommodate future development in upstream basins. Project 3C is estimated to cost $1,238,000.

APPENDIX A - ANNEXED RESIDENTIAL DATABASE

Residential Units to be Annexed
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	City?	Housing Type	Area	Total DU(1) in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow	DUE(3)	Projected Model Flow Input Manhole
							(Acres)					(GPD)(2)		
1	Koopman property	096 032000204	9480	Pleasanton-Sunol Rd	PA	LSF	2.67	1	0	0	1	732.2	3.3	SC7D3M102
2	Koopman property	096 032000213	0	Pleasanton-Sunol Rd	PA	LSF	464.15	2	0	0	2	116,468.8	529.4	SC7D3M102
3	Thompson property	096 032000300	0	Pleasanton-Sunol Rd	PA	LSF	3.23	1	0	0	1	903.0	4.1	SC8D3M101
4	Little Valley Specific Plan	096 034501200	0	Little Valley Rd	PA	LSF	246.77	61	0	36	25	75,199.9	341.8	SC7D3M102
5	Merritt /Desilva Gates	941 095000311	4131	Foothill Rd	N	LSF	25.18	43	0	40	3	6,894.8	31.3	SB4C1M402
6	Westbrook property	941 158000205	0	Dublin Canyon Rd	N	LSF	0.95	1	0	1	0	265.0	1.2	SZ2A4M100
7	Smathers Property	941 210000103	4140	Foothill Rd	N	LSF	74.27	1	0	0	1	20,833.6	94.7	SA4D4M104
8	Swartz property	941 230000110	0	Kilkare Rd	N	LSF	92.98	4	0	4	0	835.8	3.8	SA3D4M100
9	Swartz property	941 230000111	50	Tehan Canyon Rd	N	LSF	16.47	1	0	0	1	4,604.7	20.9	SA4B4M202
10	Eliasen property	941 250000100	9480	Blessing Dr	N	LSF	161.23	5	0	3	2	52,825.1	240.1	SZ2D3M400
11	Lester property	941 250000200	11033	Dublin Canyon Rd	N	LSF	0.71	1	0	0	1	246.8	1.1	SZ2A4M301
12	Lester property	941 250000300	0	Dublin Canyon Rd	N	LSF	9.96	40	0	39	1	3,067.0	13.9	SZ2A4M301
13	Jehovahs Witness (residence?)	941 270000100	0	Dublin Canyon Rd	N	LSF	2.40	1	0	0	1	641.9	2.9	SZ2A4M301
14	Shriners property	941 270000200	0	Dublin Canyon Rd	N	LSF	12.39	5	0	5	0	3,413.0	15.5	SZ2A4M100
15	DiCandia property	941 270000300	10807	Dublin Canyon Rd	N	LSF	3.41	3	0	2	1	949.4	4.3	SZ2A4M100
16	Remen Tract (unincorporated)	946 171000900	0	Vineyard Ave/Linden Way	N	MSF	7.51	80	0	50	30	2,099.2	9.5	SD5B2M403
17	Crain property	946 376000700	7700	Foothill Rd	N	LSF	13.33	7	0	6	1	3,412.5	15.5	SC8D1M300
18	Misc. SF at SE Corner Fthll & Cast	946 376001400	7050	Foothill Rd	N	LSF	0.62	17	0	0	17	173.5	0.8	SC7C2R500
19	Scarlott Property	946 378500101	0	Foothill Rd	N	LSF	2.68	1	0	0	1	806.7	3.7	SC8D1M500
20	Ostle property	946 380000202	3832	Foothill Rd	N	LSF	1.02	1	0	0	1	329.6	1.5	SB5A2M203
21	Messa property	946 380000306	3464	Foothill Rd	N	LSF	4.38	1	0	0	1	1,264.4	5.7	SB5A4M500
22	Schuhart property	946 380000310	0	Santos Ranch Rd	PA	LSF	56.78	1	0	1	0	14,665.9	66.7	SB6A2M401
23	Singh property	946 380000407	0	Santos Ranch Rd	PA	LSF	20.63	1	0	1	0	6,030.7	27.4	SB5A2M203
24	Sandhu property	946 380000408	0	Santos Ranch Rd	PA	LSF	20.08	1	0	0	1	6,038.5	27.4	SB6A2M401
25	Tolari property	946 380000409	0	Santos Ranch Rd	PA	LSF	17.36	1	0	0	1	4,113.5	18.7	SB6A2M401
26	Schuchart property	946 380000411	0	Santos Ranch Rd	PA	LSF	38.10	1	0	1	0	10,938.7	49.7	SB5A2M203
27	Tolari property	946 380000412	0	Santos Ranch Rd	PA	LSF	13.23	1	0	1	0	3,316.0	15.1	SB5A2M203
28	Lue property	946 380000500	0	Santos Ranch Rd	N	LSF	1.48	1	0	1	0	412.8	1.9	SB5A2M100
29	Lue property	946 380000600	0	Foothill Rd	N	LSF	1.28	1	0	1	0	265.0	1.2	SB5A2M100
30	Lue property	946 380000700	3984	Foothill Rd	N	LSF	43.44	3	0	3	0	265.0	1.2	SB5A2M100
31	Amador Land	946 380000900	0	Foothill Rd	N	LSF	3.98	1	0	1	0	1,550.6	7.0	SB5A2M203
32	Schuhart property	946 380001000	3688	Foothill Rd	N	LSF	5.96	1	0	0	1	1,416.4	6.4	SB5A2M203
33	Oleson property	946 380001100	3678	Foothill Rd	N	LSF	5.89	1	0	1	0	1,605.8	7.3	SB5A2M203
34	Oak Manor Ct and Way	946 405201300	0	Oak Manor Ct	N	LSF	18.05	11	0	0	11	1,561.1	7.1	SC7C2R500
35	Castlewood	946 4406	0	Castlewood Dr	N	LSF	0.23	182	0	2	180	62.8	0.3	SC7C2R500
36	Nix property	946 443600101	391	Oak Ln	N	LSF	0.41	1	0	0	1	115.0	0.5	SC8A2M202
37	Chun property	946 443600200	370	Oak Ln	N	LSF	0.81	1	0	0	1	226.0	1.0	SC8A2M202
38	Hallgrimson property	946 443600300	369	Oak Ln	N	LSF	1.21	1	0	0	1	336.2	1.5	SC8A2M202
39	Sladen property	946 443600401	7637	Foothill Rd	N	LSF	4.75	5	0	3	2	1,232.6	5.6	SC8A4M100
40	Himsl property	946 443600402	7661	Foothill Rd	N	LSF	3.07	2	0	1	1	811.1	3.7	SC8A4M100
41	Burns property	946 443600500	406	Oak Ln	N	LSF	1.29	1	0	0	1	362.7	1.6	SC8A2M202
42	Yekan property	946 443600700	407	Oak Ln	N	LSF	1.24	1	0	0	1	44.8	0.2	SC8A2M202
43	Levantine property	946 443600800	392	Oak Ln	N	LSF	1.02	1	0	0	1	285.1	1.3	SC8A4M500
44	Paulson property	946 443600900	409	Oak Ln	N	LSF	2.96	3	0	2	1	829.4	3.8	SC8A4M500
45	Varma property	946 443601000	405	Oak Ln	N	LSF	1.00	1	0	0	1	279.5	1.3	SC8A4M500
46	Marment property	946 443601100	403	Oak Ln	N	LSF	1.00	1	0	0	1	278.1	1.3	SC8A2M202
47	Kane property	946 443601200	401	Oak Ln	N	LSF	0.61	1	0	0	1	175.3	0.8	SC8A2M202
48	Gould property	946 443601300	404	Oak Ln	N	LSF	0.70	1	0	0	1	198.2	0.9	SC8A2M202
49	Hallgrimson property	946 443601400	0	Oak Ln	N	LSF	0.42	1	0	1	0	120.7	0.5	SC8A2M202
50	Pridemore property	946 443601500	399	Oak Ln	N	LSF	0.58	1	0	0	1	163.8	0.7	SC8A2M202
51	Holder property	946 443601601	393	Oak Ln	N	LSF	0.50	1	0	0	1	143.4	0.7	SC8A2M202
52	Voss property	946 444000102	7685	Foothill Rd	N	LSF	0.88	1	0	0	1	247.5	1.1	SC8A4M100
53	Malstrom property	946 444000115	7758	Country Ln	N	LSF	0.97	1	0	0	1	258.9	1.2	SC8A4M500
54	Macrae property	946 444000117	7760	Country Ln	N	LSF	0.75	1	0	0	1	188.4	0.9	SC8A4M500
55	Wedin property	946 444000119	7759	Country Ln	N	LSF	0.85	1	0	0	1	247.5	1.1	SC8A4M500
56	Juchau property	946 444000121	7757	Country Ln	N	LSF	0.86	1	0	0	1	256.8	1.2	SC8A4M500
57	Zaballos property	946 444000124	7755	Country Ln	N	LSF	0.84	1	0	0	1	238.9	1.1	SC8A4M500
58	Bidinger property	946 444000125	7756	Country Ln	N	LSF	1.00	1	0	0	1	263.3	1.2	SC8A4M500
59	Haupt property	946 444000900	7754	Country Ln	N	LSF	0.92	1	0	0	1	261.5	1.2	SC8A4M500
60	Chapman property	946 444001000	7750	Country Ln	N	LSF	1.25	1	0	0	1	371.8	1.7	SC8A4M500

Residential Units to be Annexed
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	City?	Housing Type	Area	Total DU(1) in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow	DUE(3)	Projected Model Flow Input Manhole
							(Acres)					(GPD)(2)		
61	Patel property	946 444001100	7749	Country Ln	N	LSF	2.50	2	0	1	1	750.3	3.4	SC8A4M500
62	Juchau property	946 444001300	0	Country Ln	N	LSF	24.01	3	0	3	0	7,731.7	35.1	SC7C2R500
63	Duyn property	946 444001400	7751	Country Ln	N	LSF	0.85	1	0	0	1	234.4	1.1	SC8A4M500
64	O'Rourke property	946 444001500	7753	Country Ln	N	LSF	0.81	1	0	0	1	220.8	1.0	SC8A4M500
65	Loney property	949 000600101	760	Mockingbird Ln	N	LSF	1.90	1	0	0	1	556.5	2.5	SC7B4M104
66	Jechart property	949 000600104	744	Mockingbird Ln	N	LSF	2.15	1	0	0	1	623.9	2.8	SC7B4M104
67	Bredlau property	949 000600105	728	Mockingbird Ln	N	LSF	0.99	1	0	0	1	291.0	1.3	SC7B4M501
68	Roth property	949 000600106	720	Mockingbird Ln	N	LSF	1.18	1	0	0	1	31.6	0.1	SC7B4M501
69	Kahler property	949 000600300	6152	Amber Ln	N	LSF	1.00	1	0	0	1	278.8	1.3	SC7B4M304
70	Lewis property	949 000600405	671	Sycamore Rd	N	LSF	1.20	3	0	0	3	335.8	1.5	SC7B4M104
71	Coffin property	949 000600503	727	Sycamore Rd	N	LSF	0.95	1	0	0	1	262.4	1.2	SC7B4M104
72	Avilla property	949 000600506	715	Sycamore Rd	N	LSF	0.52	1	0	0	1	146.0	0.7	SC7B4M104
73	McKewon property	949 000600600	739	Sycamore Rd	N	LSF	0.88	1	0	0	1	239.6	1.1	SC7B4M104
74	Bruns property	949 000600705	777	Sycamore Rd	N	LSF	2.45	1	0	0	1	690.3	3.1	SC7B4M104
75	Cardoza property	949 000600800	849	Sycamore Rd	N	LSF	1.22	1	0	0	1	336.3	1.5	SC7B4M104
76	Close property	949 000600900	871	Sycamore Rd	N	LSF	0.98	1	0	0	1	258.5	1.2	SC7B4M104
77	Aboud property	949 000700102	911	Sycamore Rd	N	LSF	1.01	1	0	0	1	271.6	1.2	SC7B4M104
78	Aboud property	949 000700103	925	Sycamore Rd	N	LSF	0.99	1	0	0	1	270.9	1.2	SC7B4M104
79	King property	949 000700104	6187	Alisal St	N	LSF	1.52	1	0	1	0	432.0	2.0	SC7B4M104
80	Demas property	949 000700107	969	Sycamore Rd	N	LSF	1.98	1	0	0	1	525.4	2.4	SC7B4M104
81	Guerra property	949 000701603	893	Sycamore Rd	N	LSF	1.87	1	0	0	1	519.1	2.4	SC7B4M104
82	Brogden property	949 000700203	6245	Alisal St	N	LSF	1.01	1	0	0	1	282.7	1.3	SC7B4M104
83	Antraccoli property	949 000700205	6249	Alisal St	N	LSF	1.00	1	0	0	1	283.4	1.3	SC7B4M104
84	Spencer property	949 000700207	924	Mockingbird Ln	N	LSF	1.12	1	0	0	1	316.1	1.4	SC7B4M104
85	Trimmer property	949 000700208	6192	Alisal St	N	LSF	0.94	1	0	0	1	264.6	1.2	SC7B4M104
86	Johnson property	949 000700210	910	Mockingbird Ln	N	LSF	1.18	1	0	0	1	335.4	1.5	SC7B4M104
87	Kaschmitter property	949 000700309	6291	Alisal St	N	LSF	2.84	1	0	0	1	788.1	3.6	SC7B4M104
88	Comerford property	949 000700314	999	Mockingbird Ln	N	LSF	0.96	1	0	0	1	269.2	1.2	SC7B4M104
89	Tinkham property	949 000700401	6409	Alisal St	N	LSF	0.96	1	0	0	1	277.0	1.3	SC7B4M104
90	Cook property	949 000700402	6443	Alisal St	N	LSF	0.97	1	0	0	1	267.7	1.2	SC7B4M104
91	Simpson property	949 000700500	6511	Alisal St	N	LSF	1.95	1	0	0	1	549.2	2.5	SC7B4M104
92	Dahleheim property	949 000700601	6615	Alisal St	N	LSF	5.43	2	0	1	1	1,563.3	7.1	SC7B4M104
93	Couper property	949 000700602	6525	Alisal St	N	LSF	0.98	1	0	0	1	270.5	1.2	SC7B4M104
94	Negd property	949 000700700	6639	Alisal St	N	LSF	1.05	1	0	0	1	204.6	0.9	SC7B4M104
95	Howell property	949 000700800	6651	Alisal St	N	LSF	0.69	1	0	0	1	195.7	0.9	SC7B4M104
96	Bailey property	949 000700905	6699	Alisal St	N	LSF	1.01	1	0	0	1	253.1	1.2	SC7B4M104
97	Samuli property	949 000700906	962	Happy Valley Rd	N	LSF	1.00	1	0	0	1	290.4	1.3	SC7B4M104
98	Dahleheim property	949 000700910	0	Alisal St	N	LSF	1.01	1	0	0	1	299.4	1.4	SC7B4M104
99	McMichael property	949 000700911	6767	Alisal St	N	LSF	1.04	1	0	0	1	225.3	1.0	SC7B4M104
100	Hendrix property	949 000700913	0	Alisal St	N	LSF	0.81	1	0	0	1	212.2	1.0	SC7B4M104
101	Fletcher property	949 000700914	6745	Alisal St	N	LSF	1.05	1	0	0	1	225.2	1.0	SC7B4M104
102	Samuli property	949 000700917	962	Happy Valley Rd	N	LSF	0.49	1	0	0	1	195.4	0.9	SC7B4M104
103	Hendirx property	949 000700919	6627	Alisal St	N	LSF	1.10	1	0	0	1	311.7	1.4	SC7B4M104
104	Barlow property	949 000700922	6723	Alisal St	N	LSF	1.16	1	0	0	1	338.6	1.5	SC7B4M104
105	Smith property	949 000701001	1070	Happy Valley Rd	N	LSF	1.38	1	0	0	1	265.1	1.2	SC7B4M104
106	Blair property	949 000701003	968	Happy Valley Rd	N	LSF	0.49	1	0	0	1	12.1	0.1	SC7B4M104
107	Blair property	949 000701005	970	Happy Valley Rd	N	LSF	0.62	1	0	0	1	240.7	1.1	SC7B4M104
108	Jones property	949 000701006	976	Happy Valley Rd	N	LSF	0.99	1	0	0	1	241.5	1.1	SC7B4M104
109	Vepa property	949 000701100	948	Happy Valley Rd	N	LSF	1.28	1	0	0	1	499.6	2.3	SC7D3M102
110	Smedley property	949 000701200	936	Happy Valley Rd	N	LSF	1.13	1	0	0	1	326.1	1.5	SC7D3M102
111	Morris property	949 000701302	700	Happy Valley Rd	N	LSF	1.01	1	0	0	1	275.2	1.3	SC7D3M102
112	Aura property	949 000701303	770	Happy Valley Rd	N	LSF	0.99	1	0	0	1	305.9	1.4	SC7D3M102
113	Nagengast property	949 000701304	0	Happy Valley Rd	N	LSF	10.23	5	0	5	0	3,008.8	13.7	SC7D3M102
114	Nagengast property	949 000701305	920	Happy Valley Rd	N	LSF	4.39	2	0	1	1	1,431.4	6.5	SC7D3M102
115	Woody property	949 000701402	804	Happy Valley Rd	N	LSF	0.96	1	0	0	1	284.4	1.3	SC7D3M102
116	Scherer property	949 000701403	686	Happy Valley Rd	N	LSF	1.95	1	0	0	1	537.0	2.4	SC7D3M102
117	Simons property	949 000701404	664	Happy Valley Rd	N	LSF	2.76	1	0	0	1	727.5	3.3	SC7D3M102
118	Navai property	949 000701602	0	Sycamore Rd	N	LSF	5.06	2	0	2	0	1,397.4	6.4	SC7B4M104
119	Guerra property	949 000701604	901	Sycamore Rd	N	LSF	0.93	1	0	0	1	258.2	1.2	SC7B4M104
120	Philis property	949 000701702	909	Mockingbird Ln	N	LSF	3.22	1	0	0	1	895.9	4.1	SC7B4M104

Residential Units to be Annexed
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	City?	Housing Type	Area	Total DU[1] in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
							(Acres)					(GPD)[2]		
121	Thompson property	949 000701802	6293	Laura Ln	N	LSF	2.77	1	0	0	1	775.1	3.5	SC7B4M104
122	Scott property	949 000701902	6305	Laura Ln	N	LSF	2.71	1	0	0	1	774.9	3.5	SC7B4M104
123	Morris property	949 000702100	6290	Laura Ln	N	LSF	2.03	1	0	0	1	573.8	2.6	SC7B4M104
124	Zierau property	949 000702300	6311	Laura Ln	N	LSF	1.99	1	0	0	1	558.9	2.5	SC7B4M104
125	Siamas property	949 000702400	6317	Laura Ln	N	LSF	1.99	1	0	0	1	567.7	2.6	SC7B4M104
126	DeMarta property	949 000702500	6300	Laura Ln	N	LSF	1.25	1	0	0	1	355.2	1.6	SC7B4M104
127	Ferreri property	949 000702600	6330	Laura Ln	N	LSF	1.98	1	0	0	1	543.1	2.5	SC7B4M104
128	Dohner property	949 000800303	582	Happy Valley Rd	N	LSF	2.34	1	0	0	1	637.3	2.9	SC7D3M102
129	Snider property	949 000800306	622	Happy Valley Rd	N	LSF	3.58	2	0	0	2	1,028.7	4.7	SC7D3M102
130	Heidebrecht property	949 000800400	640	Happy Valley Rd	N	LSF	4.05	2	0	1	1	1,175.1	5.3	SC7D3M102
131	Allen property	949 000800505	0	Happy Valley Rd	N	LSF	1.37	1	0	0	1	392.9	1.8	SC7D3M102
132	Allen property	949 000800506	630	Happy Valley Rd	N	LSF	0.96	1	0	0	1	249.7	1.1	SC7D3M102
133	Terpstra property	949 000800603	538	Happy Valley Rd	N	LSF	1.98	1	0	0	1	483.0	2.2	SC7D3M102
134	Goddard property	949 001000103	510	Happy Valley Rd	N	LSF	0.85	1	0	0	1	218.9	1.0	SC7D2M200
135	Morris property	949 001000104	500	Happy Valley Rd	N	LSF	0.85	1	0	0	1	201.1	0.9	SC7D2M200
136	Chaplinsky property	949 001000107	255	Happy Valley Rd	N	LSF	53.89	8	0	6	2	15,310.5	69.6	SC7D3M102
137	Wilcox property	949 001100101	581	Happy Valley Rd	N	LSF	1.42	1	0	0	1	360.3	1.6	SC7D3M102
138	Gaiero property	949 001100102	585	Happy Valley Rd	N	LSF	1.43	1	0	0	1	360.3	1.6	SC7D3M102
139	Felton property	949 001100200	657	Happy Valley Rd	N	LSF	7.87	3	0	2	1	2,047.9	9.3	SC7D3M102
140	Glafkides property	949 001100300	737	Happy Valley Rd	N	LSF	5.86	3	0	2	1	1,501.7	6.8	SC7D3M102
141	Martin property	949 001100403	909	Happy Valley Rd	N	LSF	5.28	1	0	0	1	1,600.0	7.3	SC7D3M102
142	Poropat property	949 001100406	953	Happy Valley Rd	N	LSF	1.84	1	0	0	1	524.2	2.4	SC7D3M102
143	Poropat property	949 001100408	953	Happy Valley Rd	N	LSF	3.02	1	0	0	1	937.3	4.3	SC7D3M102
144	Wicks property	949 001100410	927	Happy Valley Rd	N	LSF	2.09	1	0	0	1	605.3	2.8	SC7D3M102
145	Garcia property	949 001100411	941	Happy Valley Rd	N	LSF	5.21	1	0	0	1	1,396.3	6.3	SC7D3M102
146	Miranda property	949 001100412	933	Happy Valley Rd	N	LSF	5.26	1	0	0	1	1,386.5	6.3	SC7D3M102
147	Schaffer property	949 001100500	777	Happy Valley Rd	N	LSF	43.61	3	0	2	1	12,753.8	58.0	SC7D3M102
148	Fluker property	949 001200303	7960	Pleasanton-Sunol Rd	PA	LSF	140.70	1	0	0	1	38,364.4	174.4	SC7D3M102
149	Pedersen property	949 001300100	965	Happy Valley Rd	N	LSF	1.87	1	0	0	1	505.4	2.3	SC7D3M102
150	Dutra property	949 001300200	1053	Happy Valley Rd	N	LSF	9.99	6	0	5	1	2,770.3	12.6	SC7D3M102
151	Wentworth property	949 001300403	1157	Happy Valley Rd	N	LSF	5.49	3	0	1	2	1,468.7	6.7	SC7B4M104
152	Mortensen property	949 001400402	6748	Alisal St	N	LSF	4.93	2	0	1	1	1,510.5	6.9	SC7B4M104
153	Newman property	949 001400500	1340	Happy Valley Rd	N	LSF	4.75	2	0	1	1	1,395.4	6.3	SC7B4M104
154	Balch property	949 001500102	6010	Alisal St	N	LSF	10.04	2	0	1	1	2,979.7	13.5	SC7B4M104
155	Toomey property	949 001500105	6016	Alisal St	N	LSF	1.98	1	0	0	1	557.9	2.5	SC7B4M104
156	McCarthy property	949 001500106	6022	Alisal St	N	LSF	0.93	1	0	0	1	260.7	1.2	SC7B4M104
157	Wolf property	949 001500107	6028	Alisal St	N	LSF	0.96	1	0	0	1	267.7	1.2	SC7B4M104
158	Daggett property	949 001500108	6034	Alisal St	N	LSF	0.96	1	0	0	1	269.8	1.2	SC7B4M104
159	US Bank of California	949 001500200	6233	Alisal St	N	LSF	9.72	5	0	4	1	2,712.1	12.3	SC7B4M104
160	Gigli property	949 001500301	6350	Alisal St	N	LSF	1.52	1	0	0	1	419.6	1.9	SC7B4M104
161	Smith property	949 001500303	6344	Alisal St	N	LSF	1.53	1	0	0	1	426.7	1.9	SC7B4M104
162	Bregers property	949 001500306	6330	Alisal St	N	LSF	2.00	1	0	0	1	560.7	2.5	SC7B4M104
163	Smith property	949 001500308	0	Alisal St	N	LSF	1.49	1	0	1	0	420.3	1.9	SC7B4M104
164	Bregers property	949 001500310	0	Alisal St	N	LSF	1.06	1	0	1	0	280.5	1.3	SC7B4M104
165	Davis property	949 001500402	6306	Alisal St	N	LSF	0.99	1	0	0	1	273.8	1.2	SC7B4M104
166	Pinnella property	949 001500405	0	Alisal St	N	LSF	0.51	1	0	0	1	142.2	0.6	SC7B4M104
167	Smith property	949 001500406	6322	Alisal St	N	LSF	0.49	1	0	0	1	135.6	0.6	SC7B4M104
168	Schaaf property	949 001500408	1019	Byrd Ln	N	LSF	1.02	1	0	0	1	281.2	1.3	SC7B4M104
169	Zucco property	949 001500501	0	Alisal St	N	LSF	1.96	1	0	1	0	535.4	2.4	SC7B4M104
170	Zucco property	949 001500502	6352	Alisal St	N	LSF	2.73	1	0	0	1	713.6	3.2	SC7B4M104
171	Linfoot property	949 001500503	6300	Alisal St	N	LSF	7.39	4	0	2	2	2,053.9	9.3	SC7B4M104
172	Guasco property	949 001500600	1011	Byrd Ln	N	LSF	0.95	1	0	0	1	256.6	1.2	SC7B4M104
173	Belchik property	949 001500700	1015	Byrd Ln	N	LSF	0.96	1	0	0	1	265.7	1.2	SC7B4M104
174	Foley property	950 000800101	0	Sycamore Rd	N	LSF	605.79	18	0	18	0	173,166.2	787.1	SD6C4M402
Total							**2,530.94**	**691**	**0**	**269**	**422**	**670,392.01**	**3,047.24**	

Notes:
(1) DU = Dwelling Unit
(2) GPD = Gallons per day
(3) DUE = Dwelling Unit Equivalent = 220 GPD

APPENDIX B - VACANT AND FUTURE RESIDENTIAL/ COMMERCIAL DATABASES

Future Residential Units (All)
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	Housing Type	Area (Acres)	Total DU[1] in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow (GPD)	DUE[3]	Projected Model Flow Input Manhole
1	SF Res Downtown Bldt			Neal	MSF	88.8	5	0	5	0	209.0	0.9	SD5A3M202
2	MF Res Downtown Bldt			Augustine	Apts	38.3	25	0	25	0	290.3	1.3	SD5A3M505
3	Bras/511 Pine Hill Ln	094 001903800	511	Pine Hill Ln	LSF	0.2	1	0	1	0	268.4	1.2	SD5C4M100
4	Walsh/445 Kottinger Dr	094 002105200	445	Kottinger Dr	LSF	1.0	2	0	2	0	1,097.5	5.0	SD5C2M306
5	Walsh/445 Kottinger Dr	094 002105300	445	Kottinger Dr	LSF	0.5	2	0	2	0	549.2	2.5	SD5C2M306
6	215 Neal St Split	094 003400200	215	Neal St	LSF	0.5	2	0	1	0	510.6	2.3	SD5C3M103
7	Fracisco/4336 First St	094 003702202	4336	First St	SSF	0.1	2	0	1	1	127.3	0.6	SD5A3M505
8	Auf Der Maur property- HDR Vacant	094 008500803	3909	Vineyard Ave	LSF	2.7	41	0	41	0	4,699.3	21.4	SD5A4M407
9	Peblier/249 Spring Street	094 011002100	249	Spring St	Apts	0.2	4	0	2	2	109.1	0.5	SD5A3M406
10	LaChance	094 012700400	1072	Division St	MSF	0.3	1	0	1	0	238.7	1.1	SC5B1M201
11	Nolan Farm/ 1015 Rose Ave	094 012800400	1015	Rose Ave	MSF	1.8	41	0	3	38	1,986.0	9.0	SC5B1M300
12	New Life Church Resid Pot	941 090706200	3200	Hopyard Rd	Apts	3.0	22	0	22	0	5,079.5	23.1	SB3D3M501
13	Schaeffer/7852 Perry Ln	941 104908500	7952	Perry Ln	MSF	0.3	4	0	1	3	339.1	1.5	SA3B3M402
14	Westbrook property	941 158004600	10890	Dublin Canyon Rd	LSF	4.9	5	0	4	1	1,364.0	6.2	SZ2A4M100
15	Kolb property	941 160000400	11078	Dublin Canyon Rd	LSF	0.8	13	0	12	1	219.4	1.0	SZ2B3M401
16	Kolb property	941 160000504		Dublin Canyon Rd	LSF	0.5	1	0	1	0	136.4	0.6	SZ2B3M401
17	Church of Christ - fut res	941 160000703	11300	Dublin Canyon Rd	LSF	16.2	5	0	5	0	4,473.4	20.3	SZ2B3M302
18	Young property	941 170000502	11249	Dublin Canyon Rd	LSF	2.7	2	0	1	1	741.3	3.4	SZ2B3M302
19	Moller Ranch/Boulevard Dev. Custom	941 180200200	5488	Foothill Rd	LSF	1.4	99	3	2	94	334.6	1.5	SA3D1M100
20	Moller Ranch/Boulevard Dev. Custom	941 180201000	5488	Foothill Rd	LSF	1.0	99	3	2	94	285.1	1.3	SA3D1M200
21	Moller Ranch/Boulevard Dev. Custom	941 180201200	5488	Foothill Rd	LSF	0.9	99	3	2	94	258.9	1.2	SA3D1M200
22	Moller Ranch/Boulevard Dev. Custom	941 180201500	5488	Foothill Rd	LSF	1.1	99	3	2	94	312.0	1.4	SA3A2M500
23	Moller Ranch/Boulevard Dev. Custom	941 180201600	5488	Foothill Rd	LSF	1.9	99	3	2	94	511.7	2.3	SA3A2M500
24	Joel Property	941 190000200	25	Tehan Canyon Rd	LSF	47.6	5	0	4	1	16,023.0	72.8	SA3D4M100
25	Starnes property	941 198000400	5050	Foothill Rd	LSF	2.0	2	0	1	1	559.1	2.5	SA3D4M100
26	Starnes/Tehan Canyon Rd	941 198000800	5000	Foothill Rd	LSF	0.5	3	0	1	2	132.7	0.6	SA3D4M100
27	Flores property (formerly Ku)	941 198001503	5130	Foothill Rd	LSF	2.7	2	0	1	1	839.6	3.8	SA3D4M100
28	Thomas/5226 Foothill Rd	941 198001901	5226	Foothill Rd	LSF	0.6	5	0	1	4	166.0	0.8	SA3D4M100
29	Lemoine property	941 205000999	4455	Foothill Rd	LSF	5.9	13	0	12	1	1,636.6	7.4	SA4B4M202
30	Equus Heights/Yee	941 210000400	4100	Foothill Rd	LSF	29.1	30	0	29	1	8,002.4	36.4	SA4D4M104
31	Fuller Frades	941 210000800	4120	Foothill Rd	LSF	5.1	3	1	1	1	1,425.6	6.5	SA4D4M104
32	Fuller Frades	941 210000900	4120	Foothill Rd	LSF	10.8	3	1	1	1	3,168.8	14.4	SA4D4M104
33	Oak Hills Estate	941 281300200	11115	Dublin Canyon Rd	LSF	0.6	7	1	5	1	173.6	0.8	SZ2D3M200
34	Montgomery property	946 110419000		Trenery Dr	LSF	0.8	1	0	1	0	1,293.8	5.9	SD3A2M400
35	Eugene Lauer property	946 114604200		Martin Ave	LSF	0.8	1	0	1	0	210.7	1.0	SD3A2M400
36	Eugene Lauer property	946 114604400	2221	Martin Ave	LSF	3.5	4	0	3	1	985.2	4.5	SD2C4M406
37	Peterson property	946 114604500	2201	Martin Ave	LSF	1.7	2	0	1	1	460.4	2.1	SD2C4M406
38	Singleton property	946 114604600	2207	Martin Ave	LSF	1.7	2	0	1	1	457.9	2.1	SD2C4M406
39	Gonsalves property	946 114604700	2215	Martin Ave	LSF	1.7	2	0	1	1	458.8	2.1	SD2C4M406
40	Hacienda mobile home park	946 125001407	3231	Vineyard Ave	MH	18.7	148	0	2	146	31,581.7	143.6	SE4C3M301
41	Centex Avignon (Lonestar)	946 135001100	1465	Vineyard Ave	LSF	7.1	26	0	26	0	9,405.4	42.8	SE5A2M306
41	Centex Avignon (Lonestar)	946 135001100	1465	Vineyard Ave	LSF	21.4	26	0	26	0	9,405.4	42.8	SE5A2M306
42	Hahner property	946 135001400	2287	Vineyard Ave	LSF	17.6	31	0	30	1	11,175.8	50.8	SE5A2M306
43	Heinz property	946 135001503		Vineyard Ave	LSF	21.5	18	0	18	0	6,067.2	27.6	SE5A2M306
44	Sarich	946 135001504		Vineyard Ave	LSF	20.3	8	0	7	1	6,049.9	27.5	SE5A2M306
45	Roberts	946 135001505		Vineyard Ave	LSF	20.4	4	0	3	1	5,812.1	26.4	SE5A2M306
46	Konig property	946 135001506	1680	Vineyard Ave	LSF	20.9	7	0	6	1	5,128.0	23.3	SE5A2M306
47	Brozosky	946 135001507	1700	Vineyard Ave	LSF	19.8	4	0	3	1	5,834.3	26.5	SE5A2M306
48	Silver Oaks (Chrisman)	946 135001508		Vineyard Ave	LSF	19.5	13	0	12	1	5,696.1	25.9	SE5A2M306
49	Silver Oaks (Berlogar)	946 135001511	2200	Vineyard Ave	LSF	45.0	9	0	9	0	12,417.7	56.4	SE5A2M306
50	Molinaro/Pleasanton Garbage Svc	946 173500802		Vineyard Ave	LSF	1.6	1	0	1	0	248.4	1.1	SE5A2M306
51	McCurdy/2503 Vineyard Ave	946 173500900	2503	Vineyard Ave	LSF	3.1	6	0	5	1	962.9	4.4	SE5A2M306
51	McCurdy/2503 Vineyard Ave	946 173500900	2503	Vineyard Ave	LSF	0.7	6	0	5	1	962.9	4.4	SE5A2M306
52	Hatsushi property	946 173502000	2798	Vineyard Ave	LSF	5.1	13	0	13	0	1,385.4	6.3	SE5A2M306

Map No.	Development Name	APN	Address No.	Street	Housing Type	Area	Total DU[1] in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)					(GPD)		
53	Nespor	946 173502102	837	Clara Ln	LSF	2.2	2	0	1	1	700.9	3.2	SE5A2M306
54	Elgammal	946 173502200	865	Clara Ln	LSF	2.4	3	0	2	1	696.4	3.2	SE5A2M306
55	Vineyard Hill (Nevis)	946 173502403	2546	Vineyard Ave	LSF	8.3	9	0	9	0	2,315.8	10.5	SE5A2M306
56	Pietronave	946 173502602	2500	Vineyard Ave	LSF	2.7	3	0	2	1	839.1	3.8	SE5A2M306
57	Dominisse	946 173502700		Vineyard Ave	LSF	2.4	2	0	1	1	595.5	2.7	SE5A2M306
58	Homer	946 173502800		Vineyard Ave	LSF	2.4	1	0	1	0	655.3	3.0	SE5A2M306
59	Vineyard Hill (Gooch)	946 173502903		Vineyard Ave	LSF	2.8	4	0	4	0	135.9	0.6	SE5A2M306
60	Miller Thompson	946 173503004		Vineyard Ave	LSF	2.4	2	0	2	0	694.9	3.2	SE5A2M306
61	Vineyard Hill (Lutz)	946 173503102		Vineyard Ave	LSF	2.5	4	0	4	0	691.1	3.1	SE5A2M306
62	McGuire property	946 173503200		Vineyard Ave	LSF	7.5	9	0	9	0	8,664.6	39.4	SE5A2M306
63	Zeisse	946 347500303		Rose Ln	LSF	0.5	2	0	1	1	486.3	2.2	SC5A2M302
64	Lynden Homes (Jansen)	946 347500700	1635	Rose Ave	MSF	1.0	18	0	17	1	1,095.7	5.0	SC5A2M302
65	Jones/1725 Rose Lane	946 347700100	1725	Rose Ln	LSF	4.0	10	0	9	1	4,461.7	20.3	SC5A2M302
66	Hoile	946 347900100		Rose Ave	LSF	8.9	30	0	30	0	10,065.7	45.8	SC5A2M302
67	Wells Fargo	946 354000200		Foothill Rd	LSF	31.3	6	0	4	2	8,555.2	38.9	SB5A4M500
68	Castle Ridge/Kallenberg	946 380000313		Foothill Rd	LSF	201.3	9	0	9	0	88.0	0.4	SB5A4M500
69	Maroon Creek/2188	946 394500600	2188	Foothill Rd	LSF	12.0	12	0	11	1	3,335.3	15.2	SB6D1M401
70	Longview	946 394702200		Longview Ln	LSF	1.8	7	0	1	6	482.4	2.2	SB6D1M401
71	Golden Eagle Farm (West side cust)	946 405002700	1780	Foothill Rd	LSF	1.1	79	1	6	72	305.4	1.4	SB7B2M500
72	Golden Eagle Farm (West side cust)	946 405004800	1780	Foothill Rd	LSF	0.9	79	1	6	72	251.8	1.1	SB6D3M502
73	Golden Eagle Farm (West side cust)	946 405006100	1933	Clover Ct	LSF	0.9	79	1	6	72	247.5	1.1	SB7B1M303
74	Golden Eagle Farm (West side cust)	946 405006600	1780	Foothill Rd	LSF	1.0	79	1	6	72	270.9	1.2	SB7B1M303
75	Golden Eagle Farm (West side cust)	946 405007500	1780	Foothill Rd	LSF	0.9	79	1	6	72	249.2	1.1	SB7B1M304
76	Golden Eagle Farm (West side cust)	946 405007600	1780	Foothill Rd	LSF	1.1	79	1	6	72	298.6	1.4	SB7B1M304
77	Golden Eagle Farm (West side cust)	946 405008200	1780	Foothill Rd	LSF	1.7	79	1	6	72	473.7	2.2	SB7B1M103
78	Decoite property	946 405100100	1500	Foothill Rd	LSF	5.0	5	0	4	1	1,352.4	6.1	SB7B4M200
79	Arioto property	946 405100200	1562	Foothill Rd	LSF	2.0	2	0	1	1	544.9	2.5	SB7B4M200
80	Oak Tree Acres/Fremont Land & Dev.	946 444001600		Foothill Rd/Verona Rd	LSF	1.4	9	1	4	4	384.4	1.7	SC8D1M500
81	Oak Tree Acres/Fremont Land & Dev.	946 444001700		Foothill Rd/Verona Rd	LSF	0.9	9	1	4	4	256.7	1.2	SC8D1M500
82	Oak Tree Acres/Fremont Land & Dev.	946 444001800		Foothill Rd/Verona Rd	LSF	0.9	9	1	4	4	256.7	1.2	SC8D1M500
83	Oak Tree Acres/Fremont Land & Dev.	946 444002300		Foothill Rd/Verona Rd	LSF	0.9	9	1	4	4	256.7	1.2	SC8D1M300
84	Oak Tree Acres/Fremont Land & Dev.	946 444002400		Foothill Rd/Verona Rd	LSF	1.5	9	1	4	4	355.9	1.6	SC8D1M300
85	Grey Eagle Estates	946 456701202		Grey Eagle Ct	LSF	7.9	28	0	1	27	1,291.4	5.9	SE6B1M100
86	Undeveloped (Wiemken property)	946 457400200		Trenery Dr	LSF	1.2	2	0	2	0	359.4	1.6	SD3A2M400
87	Larson property	946 457400300	3711	Trenery Dr	LSF	1.6	2	0	1	1	429.6	2.0	SD3A2M400
88	Wiemken property	946 457400500	3747	Trenery Dr	LSF	1.0	2	0	2	0	280.7	1.3	SD3A2M400
89	Selway property	946 457400600	2313	Martin Ave	LSF	5.1	10	0	9	1	1,325.7	6.0	SD3A2M400
90	Lehman property	946 457400700	3757	Trenery Dr	LSF	14.6	28	0	27	1	4,197.9	19.1	SD3A4M407
91	Jennaro/ 3727 Mohr Ave	946 457401102	3727	Mohr Ave	MSF	5.0	6	0	5	1	1,410.1	6.4	SD3C2M405
92	Beratlis Place/Beratlis	946 457903202	10	Beratlis Pl	LSF	7.9	15	0	14	1	2,243.2	10.2	SE5C3M102
93	Pleasanton Est./Victoria Meadows	946 458001400		Montevino Dr	MSF	0.2	42	0	1	41	246.7	1.1	SE5A4M200
94	Oak Tree Farm/Currin	946 458500100	8015	Foothill Rd	LSF	0.9	41	4	2	35	271.4	1.2	SC8D3M101
95	Oak Tree Farm/Currin	946 458500700	8015	Foothill Rd	LSF	0.8	41	4	2	35	226.8	1.0	SC8D3M101
96	Oak Tree Farm/Currin	946 458502900	8015	Foothill Rd	LSF	0.7	41	4	2	35	207.5	0.9	SC8D3M101
97	Oak Tree Farm/Currin	946 458504000	8015	Foothill Rd	LSF	0.5	41	4	2	35	134.5	0.6	SC8D3M101
98	Oak Tree Farm - Phase III	946 458504500	8015	Foothill Rd	LSF	9.6	9	0	9	0	2,310.7	10.5	SC8D3M101
99	Oak Tree Farm/Currin	946 458504700	8015	Foothill Rd	LSF	0.6	41	4	2	35	363.3	1.7	SC8D3M101
100	Oak Tree Farm/Currin	946 458504800	8015	Foothill Rd	LSF	1.0	41	4	2	35	311.6	1.4	SC8D3M101
101	Busch SF to Mohr Ave	946 459499999		Mohr Ave	LSF	0.3	47	0	47	0	25,439.4	115.6	SD3D3M401
102	Village III - Standard Pacific			Stoneridge Dr	SSF	3.6	143	9	0	134	129.5	0.6	SD2D2M418
103	Walnut Hills -Duets (central area)			Bernal Ave	Duets	21.9	20	6	0	14	1,744.4	7.9	SC5C3M205
104	Carlton Oaks - Duets (west side)			Bernal Ave	Duets	162.4	10	0	10	0	8,708.0	39.6	SC6C1M200
105	Canyon Oaks -Duets (east side)			Case Avenue	Duets	50.9	26	0	26	0	13,160.2	59.8	SC6D1M101
106	Greenbriar - Bridle Creek		878	Sycamore Rd	LSF	55.6	111	11	0	100	146.8	0.7	SC7B2M202

Future Residential Units (All)
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	Housing Type	Area	Total DU(1) in Project	DUs in Project Under Construction	DUs w/o Building Permits	Existing DUs in Project	Projected Flow	DUE(3)	Projected Model Flow Input Manhole
						(Acres)					(GPD)		
107	Castlewood Heights/Pulte			Sunol Blvd	LSF	18.1	29	11	0	18	187.5	0.9	SC7D1M400
108	Auf Der Maur property	948 000400603	4534	Bernal Ave	MSF	9.2	50	0	49	1	10,031.9	45.6	SD6C2M101
109	Lund Ranch II	948 001500104		Lund Ranch Rd	LSF	194.0	82	0	81	1	53,284.0	242.2	SD6C4M402
110	Spotorno property	948 001500201		Minnie Rd	LSF	43.2	75	0	75	0	48,979.9	222.6	SD7A1M300
111	Spotorno property	948 001500202		Minnie Rd	LSF	3.7	6	0	5	1	992.6	4.5	SD7A1M300
112	Bringhurst property	948 001600209	990	Sycamore Rd	LSF	3.3	3	0	2	1	956.9	4.3	SD7A1M300
113	Ward/Locke property	948 001600300	982	Sycamore Rd	LSF	1.4	3	0	2	1	379.5	1.7	SD7A1M300
114	Richey property	948 001600400	974	Sycamore Rd	LSF	1.4	3	0	2	1	415.8	1.9	SD7A1M300
115	Kass property	948 001601200	966	Sycamore Rd	LSF	4.5	5	0	4	1	1,222.8	5.6	SD7A1M300
116	New Cities- Sycamore Heights	948 001601300	986	Sycamore Rd	LSF	20.0	49	0	48	1	372.6	1.7	SD7A1M300
117	Moreira property	948 001700103	558	Sycamore Rd	LSF	2.3	4	0	3	1	612.2	2.8	SC7B2M202
118	Bach property	948 001700505	446	Sycamore Rd	LSF	1.8	4	0	1	3	512.4	2.3	SC7B2M303
119	Greene property	948 001700603	386	Sycamore Rd	LSF	3.1	6	0	5	1	887.4	4.0	SC7B2M300
120	Benevedes property	948 001700702	362	Sycamore Rd	LSF	1.1	2	0	2	0	284.4	1.3	SC7B2M200
121	Daggett property	948 001700704		Sycamore Rd	LSF	1.5	3	0	2	1	424.6	1.9	SC7B2M200
122	Hafker Property (Backer Neal)	948 001701001	530A 565	Sycamore Rd	LSF	1.3	2	0	1	1	362.7	1.6	SC7B2M202
123	Bozorgzad property	948 001701200	488	Sycamore Rd	LSF	0.7	4	0	2	2	182.0	0.8	SC7B2M303
124	Bonde Ranch	948 001901800		Bernal Ave	MSF	0.3	65	0	1	64	95.1	0.4	SD6C2M504
125	Thompson/6240 Sunol Blvd	949 000200102	6240	Sunol Blvd	MSF	0.9	3	0	2	1	1,029.8	4.7	SC7B1M400
126	Dingman property	949 000200500	387	Sycamore Rd	LSF	0.5	1	0	0	1	144.7	0.7	SC7B2M300
127	Macari property	949 000200702	455	Sycamore Rd	LSF	1.1	2	0	1	1	313.7	1.4	SC7B1M400
128	Ziemer property	949 000200800	535	Sycamore Rd	LSF	1.8	2	0	1	1	526.4	2.4	SC7B2M402
129	Carriage Gardens/Pestana	949 000400100		Amber Ln	LSF	0.5	49	0	3	46	134.9	0.6	SC7D1M103
130	Carriage Gardens/Pestana	949 000401100		Amber Ln	LSF	1.1	49	0	3	46	313.3	1.4	SC7D2M200
131	Carriage Gardens/Pestana	949 000401700		Amber Ln	LSF	0.7	49	0	3	46	188.1	0.9	SC7D2M200
132	Heather Hill	949 000500500			LSF	0.9	13	0	1	12	251.2	1.1	SC7D2M306
133	TTK	949 001300303	1073	Happy Valley Rd	LSF	13.9	12	0	12	0	3,966.1	18.0	SC7D3M102
134	Spotorno property	949 001400100		Alisal St	LSF	111.2	16	0	16	0	30,762.0	139.8	SC7B4M104
135	Mun Golf Course Lots	949 001400800		Happy Valley Rd	LSF	74.0	37	0	34	3	20,698.7	94.1	SC7B4M104
136	Kottinger Ranch	950 000309600		Hearst Dr	LSF	2.8	147	0	1	146	779.7	3.5	SE6A3M400
137	Kottinger Hills/Lin	950 000400206		Hearst Dr	LSF	560.0	98	0	98	0	156,367.1	710.8	SE6A3M502
138	Foley Property	950 000500700		Vineyard Ave	LSF	0.8	1	0	1	0	500.5	2.3	SE5A2M306
139	Simoni property	950 000600301		Vineyard Ave	LSF	50.2	1	0	1	0	15,930.3	72.4	SE5A2M306
139	Simoni property	950 000600301		Vineyard Ave	LSF	2.3	1	0	1	0	180.0	0.8	SE5A2M306
139	Simoni property	950 000600301		Vineyard Ave	LSF	0.5	1	0	1	0	180.0	0.8	SE5A2M306
140	Ruby Hill/Signature Properties			Vineyard Ave/Isabel Ave	LSF	26.7	849	30	157	662	340.1	1.5	SF6D4M200
Total						**2,357.3**	**4,289**	**121**	**1,341**	**2,826**	**640,062.4**	**2,909.4**	

Notes:
(1) DU = Dwelling Unit
(2) GPD = Gallons per day
(3) DUE = Dwelling Unit Equivalent = 220 GPD

Map No.	Development Name	APN	Address No.	Street	Land Use	Area	Gross Area	No. Hotel Rooms	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)	(SF)[1]		(GPD)[2]		
1	Retail Buildout in Downtown	094 000001	0	Main St	Shopping Center	69.0	20,000	0	243.9	1.1	SD5A3M202
2	Village High School-Addt Bldt Enrl	094 000100103	4645	Bernal Ave	School	10.7	0	34	6,083.8	27.7	SD5C3M400
3	350 Main St bldg (2nd story addn)	094 010200500	350	Main St	Shopping Center	0.1	6,174	0	97.4	0.4	SC5D2M503
4	Pleas. Station (New Office Bldg.)	094 010301500	55	W Angela St	Office	0.4	7,700	0	278.5	1.3	SC5D2M503
5	Office - Wevill	094 010700500	240	Spring St	Office	0.1	2,420	0	55.9	0.3	SD5A3M406
6	Office Building	094 010800604	325	Ray St	Office	1.5	15,400	0	901.0	4.1	SD5A3M203
7	Mendez Addition	094 011004000	218	Ray St	Office	0.2	1,478	0	121.9	0.6	SD5A3M203
8	Ranay Office - New Building	094 015100802	344	Division St	Office	0.1	4,242	0	83.9	0.4	SC5B4M504
9	Undeveloped	094 015203000	453	Main St	Shopping Center	0.1	0	0	38.7	0.2	SC5D2M503
10	Marment HDR Remnant Parcel	094 015602200	201	Old Bernal Ave	Office	0.3	4,950	0	186.7	0.8	SC5D4M202
11	SF Remainder (Future City Hall?)	094 015700517	0	Old Bernal Ave	Public/Institutional	3.1	47,415	0	1,860.4	8.5	SC5D4M200
12	former Mobil svc sta site	094 019900107	1024	Santa Rita Rd	Office	0.3	3,506	0	134.6	0.6	SD5A1M203
13	Alisal Elementary School-Addt Bldt	094 021503602	1454	Santa Rita Rd	School	9.6	0	81	5,658.3	25.7	SD4C1M302
14	Foothill High School-Addt Bldt Enr	941 100000223	4375	Foothill Rd	School	42.8	0	71	25,339.4	115.2	SB4A3M200
15	GEF Corp (132-unit sr care fac)	941 120101502	5700	Pleasant Hill Rd.	Retirement Home	2.5	112,934	132	1,464.3	6.7	SA2C4M500
16	Kaiser Clinic (MOB 4 + future)	941 120105201	0	Stoneridge Dr	Medical Office	19.2	168,248	0	11,246.5	51.1	SA2D1M400
17	BART Property	941 120107104	6110	Stoneridge Mall Rd	Office	8.5	169,307	0	5,066.6	23.0	SA2B3M101
18	Stoneridge Mall (future sq. ft.)	941 120109400	1	Stoneridge Mall Rd	Regional Shopping Center	28.7	380,000	0	17,269.1	78.5	SA2D1M300
19	Undeveloped (Clorox)	941 130001500	0	Johnson Dr	R&D	2.4	31,193	0	1,295.7	5.9	SB2C1M400
20	Pac Bell's New Parking & Building	941 130001800	7240	Johnson Dr (addition)	Industrial Park	1.9	4,000	0	1,157.8	5.3	SB2C1M200
21	Undeveloped (Clorox/7028 Commerce)	941 131103000	7028	Commerce Cir	R&D	0.9	12,423	0	555.9	2.5	SB2A3M200
22	Former Dillingham Bldg. - Fut. Pad	941 131103603	7100	Johnson Dr	Office	4.4	39,265	0	2,520.1	11.5	SB2A3M200
23	Hotel & AVAC Remnant Parcel	941 131103804	7090	Johnson Dr	Office	2.7	65,338	0	1,423.7	6.5	SA1D4M500
24	AIF Holding	941 171000800	0	Dublin Canyon Rd	Office	0.8	12,196	0	436.6	2.0	SA2A3M500
25	Bison Inv (Stewart-Kramer site)	941 171001001	11991	Dublin Canyon Rd	Office	1.2	32,017	0	635.3	2.9	SA2A3M500
26	EBRPD (Garms Ranch) - P&I Portion	941 200006300	4440	Foothill Rd	Church/Synagogue/Religious	26.5	50,000	0	15,732.2	71.5	SA4B4M202
27	Quaker Oats (Prop. Phase 2)	941 275902300	4576	Willow Rd	Office	5.2	45,500	0	3,060.0	13.9	SB2D4M505
28	Hopyard Plaza-Chamberlin Assoc	941 275902400	5075	Hopyard Rd	Office	2.7	44,250	0	1,602.6	7.3	SB2B4M500
29	Taylor Building	941 275904900	4701	Chabot Dr	Office	1.4	24,600	0	816.1	3.7	SB2B4M300
30	Rinc One Cap Alloc	941 276001100	5964	W Las Positas Blvd	Office	6.2	19,000	0	3,665.3	16.7	SB3B4M500
31	Hac West Cap Alloc	941 276001901	3825	Hopyard Rd	Office	14.0	65,000	0	8,449.1	38.4	SB3D2M301
32	Roche Molecular Systems (Ph 2)	941 276100300	4300	Hacienda Dr	Office	33.3	39,133	0	19,943.8	90.7	SB2D2M500
33	Assoc. Center - HBP Cap1 Alloc	941 276100403	4301	Hacienda Dr	Office	16.4	57,000	0	9,787.8	44.5	SC2C1M300
34	Amador HBP Cap Alloc	941 276201301	5724	W Las Positas Blvd	Office	4.9	40,000	0	2,973.5	13.5	SC3A3M300
35	Hac Lakes - HBP Cap Alloc	941 276201600	4234	Hacienda Dr	Office	15.8	70,000	0	9,442.6	42.9	SC3A1M402
36	Hart Middle School-Addt Bldt Enrol	941 276201900	4433	Willow Rd	School	19.0	0	96	11,303.2	51.4	SB3B2M501
37	General Electric - Addition	941 276202000	4160	Hacienda Dr	Office	2.7	10,676	0	1,617.4	7.4	SC3A1M402
38	Brit Bus Center HBP Cap1 Alloc	941 276202203	5870	Stoneridge Dr	Office	8.0	20,283	0	4,754.5	21.6	SB2D4M303
39	Diablo - HBP Cap Alloc	941 276202400	5627	Gibraltar Dr	Office	0.9	20,000	0	552.9	2.5	SC3A1M403
40	Unisource (Ph 2)	941 276302900	4225	Hacienda Dr	High Cube Warehouse	22.3	145,340	0	13,312.0	60.5	SC3A1M301
41	Nearon Enterp (Ph 2 of former HP)	941 276400200	5725	W Las Positas Blvd	Office	10.3	55,417	0	6,250.6	28.4	SC2D3M501
42	St Bus Cen - Cap Alloc	941 276400600	5653	Stoneridge Dr	Office	11.4	20,000	0	6,733.5	30.6	SC3B1M102
43	Herald Cap Alloc	941 277102900	4770	Willow Rd	Office	3.4	18,000	0	2,142.6	9.7	SB2B2M500
44	Peoplesoft - Bldg. D next to BART	941 277800305	4520	Peoplesoft Pkwy	Office	20.5	180,996	0	11,664.5	53.0	SC2A2M500
45	Shaklee	941 277801000	4705	Willow Rd.	Office	28.7	500,000	0	17,084.5	77.7	SC2A3M301
46	WalMart (Phase 2)	941 277900700	4501	Rosewood Dr	Promotional Center	15.1	30,000	0	8,805.2	40.0	SC2A2M401
47	AT&T Cap Alloc	941 278001901	4400	Rosewood Dr	Office	58.5	43,000	0	35,036.9	159.3	SC2B1M400
48	Kolb Property - Senior Care		11393	Dublin Canyon Rd	Retirement Home	5.1	90,000	100	3,014.4	13.7	SZ2B3M302
49	Underdeveloped Parcel	946 110000400	3944	Old Santa Rita Rd	Shopping Center	0.6	9,453	0	348.0	1.6	SC2D2M400
50	Underdeveloped Parcel	946 110000900	3744	Old Santa Rita Rd	Shopping Center	0.9	12,806	0	546.9	2.5	SC2D2M400
51	Underdeveloped Parcel	946 110001200	3640	Old Santa Rita Rd	Shopping Center	1.6	20,908	0	980.1	4.5	SC2D2M400
52	Vacant - Prop. Medical Office	946 110001701	3601	Santa Rita Rd	Medical Office	3.5	60,829	0	2,133.9	9.7	SC2B4M303
53	Fairlands Elem School-Addt Bldt En	946 110600104	4151	W Las Positas Blvd	School	7.8	0	10	4,664.9	21.2	SD2C3M102
54	Staples Ranch II - Warehouse	946 112800307	0	El Charro Rd	Warehouse	126.4	243,065	0	73,453.3	333.9	SD2B4M401

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Map No.	Development Name	APN	Address No.	Street	Land Use	Area	Gross Area	No. Hotel Rooms	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)	(SF)[1]		(GPD)[2]		
55	Hacienda School- (private) Ph.2	946 114400200	3800	Stoneridge Dr	School	3.5	7,692	159	2,203.4	10.0	SD2C4M307
56	Fut. Kaiser- "K3"	946 125000600	3000	Busch Rd	Industrial Park	107.0	417,261	0	63,044.1	286.6	SD4B1M402
56	Fut. Kaiser	946 125001901	3000	Busch Rd	Industrial Park	160.7	0	0	53,043.6	241.1	SD4B1M402
57	Fut. Kaiser- "K5"		3000	Busch Rd	Industrial Park	31.0	40,510	0	18.9	0.1	SD2D2M418
58	EBRPD Waterslide Expansion	946 125000818	0	Stanley Blvd	Public Park - Regional Park	41.5	0	0	22,969.6	104.4	SD4D3M201
59	EBRPD 2A pkg. & 8A BMX park	946 125001003	3320	Stanley Blvd	Public Park - Regional Park	11.1	0	0	6,617.1	30.1	SD4D3M201
60	PGS - Expansion	946 125003900	3110	Busch Rd	Industrial Park	3.3	8,075	0	1,894.6	8.6	SD4B1M402
61	Undeveloped (Outdoor Storage Area)	946 125100204	3500	Valley Ave	Industrial Park	13.5	127,977	0	8,779.7	39.9	SD4C4S207
62	Utility Vault (Future Dev)	946 125100302	3786	Valley Ave	Industrial Park	6.9	54,660	0	3,161.5	14.4	SD4C4S207
63	Kiewit: Future Development	946 125100704	3200	Busch Rd	Industrial Park	49.0	657,936	0	28,363.1	128.9	SD4B1M402
64	Western Concrete (Future Dev)	946 125101000	3500	Boulder St	Industrial Park	7.0	179,050	0	4,219.4	19.2	SD4C4S207
65	Vacant (former All-American Oil)	946 125102900	3100	Valley Ave	Industrial Park	1.8	25,657	0	1,061.7	4.8	SD4C4S207
66	Bay Area Self-storage	946 125103000	3101	Valley Ave	Self-Storage	6.9	139,928	0	5,016.2	22.8	SD4B1M402
67	Joshua A. Neal Elementary School	946 135001301	0	Vineyard Ave	School	13.3	0	660	7,521.1	34.2	SE5A2M306
68	Irby (Future Commercial)	946 168000203	3780	Stanley Blvd	Shopping Center	9.3	52,272	0	5,522.4	25.1	SD4D3M300
69	Kaplan (Future Development)	946 168000302	3878	Stanley Blvd	Shopping Center	1.5	13,155	0	983.7	4.5	SD4D3M300
70	Rosa (Future Commercial)	946 168000404	3988	Stanley Blvd	Industrial Park	4.1	26,136	0	2,464.9	11.2	SD5A2M303
71	Undeveloped (Spencer Mortuary/Fir)	946 168000500	0	First St	Shopping Center	0.3	4,878	0	190.0	0.9	SD5A4M105
72	PGS - Future Community Park	946 173500803	0	Vineyard Ave	Public Park - Neighborhood Pa	20.4	0	0	12,547.7	57.0	SE5A2M306
73	Valley View Elem School-Addt Bldt	946 252800106	488	Adams Way	School	8.4	0	32	5,024.1	22.8	SD5B3M405
74	Undeveloped - Armax 4-Bldg. Office	946 305201300	1030	Happy Valley Rd	Office	0.7	73,028	0	431.8	2.0	SC7C4M100
75	ValleyCare - Adm, Labs, etc	946 320002900	4955	Owens Dr	Medical Office	4.6	40,190	0	2,785.5	12.7	SC2D1M304
76	ValleyCare - MOB 3 (flrs. 2 & 3)	946 320003500	5555	W Las Positas Blvd	Medical Office	11.4	42,000	0	6,887.5	31.3	SC2D1M210
77	Valley Care - Skilled Nursing II	946 320003600	0	Owens Dr	Hospital	6.1	58,000	0	3,627.7	16.5	SC2B4M400
78	Harvest Middle School-Addt Bldt En	946 334000309	4900	Valley Ave	School	20.0	0	142	12,005.5	54.6	SC4A4M202
79	Amador HS-Addt Bldt Enrlmt	946 336700405	1155	Santa Rita Rd	School	18.4	0	108	10,833.8	49.2	SD5A1M106
80	Valley Community Church - School	946 337004908	4455	Del Valle Pkwy	Church/Synagogue/Religious	3.0	7,523	0	1,792.4	8.1	SC5B2M105
81	Undeveloped (Miracle Auto)	946 454200200	3	Wyoming St	Shopping Center	0.6	10,152	0	372.1	1.7	SD4D3M201
82	Undeveloped (19 Wyoming)	946 454200300	19	Wyoming St	Shopping Center	0.7	8,625	0	388.6	1.8	SD4D3M201
83	Undeveloped	946 454202100	3595	Utah St.	Industrial Park	0.6	8,233	0	372.8	1.7	SD4D3M201
84	Undeveloped (3597 Utah St)	946 454202200	3597	Utah St.	Industrial Park	0.6	7,449	0	336.1	1.5	SD4D3M201
85	Proposed Print Shop	946 454203400	3589	Nevada St	Industrial Park	1.0	16,102	0	580.2	2.6	SD4D3M201
86	Peridot	946 454203600	3283	Bernal Ave	Industrial Park	1.4	20,982	0	844.0	3.8	SD4D3M201
87	Undeveloped (Arco Site)	946 454203900	3581	Utah St	Industrial Park	0.6	0	0	369.0	1.7	SD4D3M201
88	Undeveloped (Arco)	946 454204000	3121	Bernal Ave	Industrial Park	0.6	4,600	20	372.1	1.7	SD4D3M201
89	McDonalds' Future C-S Building	946 454204102	3001	Bernal Avenue	Industrial Park	1.8	5,220	0	1,013.3	4.6	SD4D3M201
90	Undeveloped (6 Wyoming St)	946 454204202	6	Wyoming St	Industrial Park	1.6	20,647	0	894.9	4.1	SD4D3M201
91	Undeveloped (Stanley Bus Pk II)	946 454204600	0	Bernal Ave/Nevada Ct	Shopping Center	2.1	210,003	0	1,053.1	4.8	SD4D3M201
92	Beth Emek Synagogue	946 454204500	2500	Stanley Blvd	Church/Synagogue/Religious	16.0	9,986	0	9,505.4	43.2	SD4D3M201
93	Panatonni - Pls. Power Park (Borg)	946 454723100	3700	Boulder St	Industrial Park	11.7	19,633	0	7,012.7	31.9	SD4C4S207
94	St. Seton Church-Fut. Elem. School	946 455000303	0	Stoneridge Dr	School	8.9	39,000	200	5,309.8	24.1	SD3A1M305
95	Thorpe Office Building	946 455703001	6600	Koll Center Pkwy	Office	1.9	22,660	0	873.3	4.0	SB5D2M401
96	Bernal Neigh Park	946 459200200	0	Bernal Ave	Public Park - Neigh Park	4.9	0	5	2,902.0	13.2	SB6D2M402
97	Busch-Magnet High School	946 459499999	0	Mohr Ave	School	23.0	0	500	867.9	3.9	SD4B2J306
97	Presbyterian Church	946 459499999	0	Busch Rd	Church/Synagogue/Religious	5.7	86,200	0	3,383.1	15.4	SD4B1M402
98	Hearst Elementary School-Addt Bldt	947 000302800	5301	Case Ave	School	10.9	0	102	6,412.0	29.1	SC6B3M500
99	Applied Bio - Bldgs. C&D	947 000500407	6075	Sunol Blvd	R&D	60.0	276,479	0	47,778.4	217.2	SC6C4M200
100	Pleasanton Middle School-Addt Bldt	947 000800500	5001	Case Ave	School	26.7	0	23	15,627.7	71.0	SC6B3M200
100	Pleasanton Middle School-Addt Bldt	947 000800500	5001	Case Ave	School	0.3	0	23	80.4	0.4	SC6B2M100
101	SFWD - Office Phase 1 (2 bldgs)	947 000801700	0	Bernal Avenue	Office	39.5	186,250	0	23,287.4	105.9	SC6A1M303
102	Bernal Shell Station w/ Car wash	947 000801900	0	Bernal Ave	Gas Station w/mart & carwash	1.3	3,500	13	815.2	3.7	SB5D4M307
103	SFWD- High School	947 000802500	0	Valley Ave	School	59.5	60,000	700	35,246.2	160.2	SC6A4M400
104	Fire Station #4	947 000802600	1600	Oak Vista Way	Fire Station	3.3	7,680	0	35.4	0.2	SC5C3M205
105	SFWD- Daycare	947 000802700	0	Valley Ave	Day Care	1.1	12,000	150	45.7	0.2	SB5D4M307

Future COI/Schools/Parks
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Map No.	Development Name	APN	Address No.	Street	Land Use	Area (Acres)	Gross Area (SF)[1]	No. Hotel Rooms	Projected Flow (GPD)[2]	DUE[3]	Projected Model Flow Input Manhole
106	Bernal Comm. Park	947 000802900	0	Bernal Ave	Public Park - Community Park	46.0	0	45	27,481.9	124.9	SC5D3M500
107	Bridge Senior Assist. (105 Bds)	947 001100200	100	Junipero Street	Retirement Home	3.6	95,361	105	2,582.0	11.7	SC6B3M401
108	Marsh "triangle" property	948 000400200	5998	Sunol Blvd	Office	0.7	11,434	0	382.2	1.7	SC6D3M300
109	Undeveloped (Cobler)	948 000802402	5502	Sunol Blvd	Office	0.5	7,775	0	303.8	1.4	SC6D2M200
110	Undeveloped (Brentwood Holding Co)	948 000900100	5791	Sonoma Dr	Industrial Park	0.7	9,453	0	421.8	1.9	SC6D2M502
111	Undeveloped (Brentwood Holding Co)	948 000900200	5779	Sonoma Dr	Industrial Park	0.6	7,832	0	347.1	1.6	SC6D2M502
112	NSSP Office Parcel (Lot 4)	948 001700804	5980	Sunol Blvd	Office	1.0	13,200	0	611.4	2.8	SC6D3M500
113	NSSP Office Parcel (Lot 5)	948 001700806	336	Sycamore Rd	Office	0.6	13,000	0	374.7	1.7	SC7B1M101
114	South Front Investors	949 000200304	6088	Sycamore Rd	Office	1.3	18,746	0	789.4	3.6	SC7B1M101
115	Municipal 18-hole Golf Course	949 001400300	0	Happy Valley Rd	Golf Course	40.0	7,000	18	35,561.0	161.6	SC7B4M104
116	Ruby Hill - Future Winery II	950 001000700	0	Vineyard Ave/Isabel Av	Winery	55.0	30,000	0	32,639.2	148.4	SG6C1M302
117	Winery - Future Restaurant/Event C	950 001004500	1188	Vineyard Avenue	Conference Center	107.2	14,000	0	500.5	2.3	SE5A2M306
118	Ruby Hill - Future Winery	950 001004600	0	Vineyard Ave/Isabel Av	Winery	36.2	30,000	0	20,677.3	94.0	SG6C1M302
Total						**1,828.7**	**6,344,592**	**3,529**	**925,490.2**	**4,206.8**	

Notes:
(1) SF = Square Feet
(2) GPD = Gallons per day
(3) DUE = Dwelling Unit Equivalent = 220 GPD

Vacant Existing COI
Revised December 18, 2003

Map No.	Development Name	APN	Address No.	Street	Land Use	Area	Gross Area	Usable Area	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)	(SF)[1]		(GPD)[2]		
1	PLEASANTON STATION (bldg 2)	094 010200602	4625	First St	Shopping Center	1.0	11,351	11,351	587.2	2.7	SD5C3M300
2	William Gale Atty	094 010300100	62	Neal St	Office	0.1	4,374	4,374	78.5	0.4	SD5C1M300
3	450 MAIN ST. BUILDING	094 010300803	450	Main St	Office	0.4	22,940	22,940	11.8	0.1	SD5C1M300
4	PLEASANTON STATION	094 010301600	30	W Neal St	Shopping Center	0.6	6,500	6,500	362.0	1.6	SD5C1M300
5	Grape Video Recording Co	094 010400701	89	Neal St	Office	0.1	600	600	78.9	0.4	SD5C1M300
6	Flower House Design Studio	094 010600308	120	Spring St	Office	0.5	3,550	3,550	256.3	1.2	SD5A3M501
7	MULTI-TENANT	094 010600702	4377	First St	Shopping Center	0.4	1,725	1,725	231.9	1.1	SD5C1M302
8	Gretta Lane Partners	094 010700400	252	Spring St	Office	0.1	1,200	1,200	52.2	0.2	SD5A3M406
9	(Office)	094 010701201	215	Division St	Office	0.3	953	953	184.6	0.8	SD5C1M203
10	Coffee Roast Express/Churka	094 011003103	780	Main St	Restaurant - High Turnover	0.4	6,888	6,888	209.0	0.9	SD5A3M202
11	Don Mendez Insurance	094 011004000	218	Ray St	Office	0.2	1,047	1,047	121.9	0.6	SD5A3M203
12	MULTI-TENANT	094 011004703	4183	First St	Shopping Center	0.2	4,803	4,803	140.6	0.6	SD5A4M105
13	Church of the Divine Man (2nd fl)	094 012303000	328	St. Mary St	Shopping Center	0.1	3,400	3,400	85.5	0.4	SD5A3M400
14	MULTI-TENANT	094 015100806	555	Peters Ave	Office	0.7	11,108	11,108	372.1	1.7	SC5B4M504
15	Branagh Retail/Office Building	094 015600703	349	Main St	Shopping Center	0.4	12,662	12,662	240.1	1.1	SC5D4M205
16	Ken Gooch & Assoc/Orion Homes	094 015601102	1	Peters Ave	Office	0.1	1,948	1,948	60.5	0.3	SC5D4M100
17	MULTI-TENANT	094 015602100	231	Old Bernal Ave	Office	0.5	6,160	5,404	130.0	0.6	SC5D4M202
18	DOWNTOWN CENTRE (bldg 3)	094 015700104	235	Main St	Shopping Center	0.3	3,749	3,749	175.3	0.8	SC5D4M301
19	DOWNTOWN CENTRE (bldg 2a)	094 015700202	205	Main St	Shopping Center	0.8	8,063	8,063	480.0	2.2	SC5D4M401
20	A Dream Come True	094 015700900	252	Main St	Shopping Center	0.1	1,071	1,071	82.6	0.4	SC5D4M401
21	MULTI-TENANT	094 015701100	234	Main St	Shopping Center	0.2	5,651	5,651	100.3	0.5	SC5D4M401
22	Sjoberg offc bldg site	094 015702600	5000	Pleasanton Ave	Office	0.9	22,848	22,848	509.4	2.3	SC5D3M203
23	PLEASANTON STATION (bldg 3)	094 015702800	4713	First St	Shopping Center	0.9	19,729	19,550	541.5	2.5	SC5D4M402
24	Foothill Professional Center	941 120103500	5820	Stoneridge Mall Rd	Office	3.1	74,201	70,352	1,909.4	8.7	SA2C2M301
25	Atrium Building	941 120104800	5776	Stoneridge Mall Rd	Office	3.6	76,253	71,638	2,043.3	9.3	SA2C2M301
26	Courtney Office (EFS)	941 120105000	5700	Stoneridge Mall Rd	Office	2.3	43,032	43,032	1,336.5	6.1	SA2C2M400
27	Kacor Building	941 120105400	7901	Stoneridge Dr	Office	7.0	175,230	171,009	4,104.2	18.7	SA2C2M400
28	Stoneridge Corp Plaza (Bldg 1)	941 120108400	6140	Stoneridge Mall Rd	Office	7.3	191,431	190,447	4,332.7	19.7	SA2B3M100
29	Stoneridge Corp Plaza (Bldg 2)	941 120108500	6150	Stoneridge Mall Rd	Office	3.5	73,354	72,029	1,888.5	8.6	SA2B3M101
30	Stoneridge Corp Plaza (Bldg 4)	941 120108600	6120	Stoneridge Mall Rd	Office	5.1	73,000	71,675	3,050.3	13.9	SA2B3M101
31	Stoneridge Corp Plaza (Bldg 3)	941 120108800	6130	Stoneridge Mall Rd	Office	3.9	116,737	113,246	2,464.2	11.2	SA2B3M100
32	Stoneridge Corp Plaza (Bldg 5)	941 120108900	6160	Stoneridge Mall Rd	Office	3.2	116,737	110,432	2,033.1	9.2	SA2B3M100
33	Stoneridge Mall (shops I)	941 120109400	1	Stoneridge Mall Rd	Regional Shopping Center	28.7	388,835	388,835	17,269.1	78.5	SA2D1M300
34	Pleasanton Hines - First Bldg	941 120109600	6200	Stoneridge Mall Rd	Office	6.8	151,187	151,187	3,797.2	17.3	SA2B4M400
35	Pleasanton Hines - Fourth Buildin	941 120109700	6210	Stoneridge Mall Rd	Office	7.7	151,187	151,187	4,814.2	21.9	SA2B4M400
36	Pleasanton Hines - Second Bldg	941 120109800	6220	Stoneridge Mall Rd	Office	6.8	151,187	151,187	4,037.5	18.4	SA2B4M401
37	Owens-Hopyard Plaza	941 130101602	5323	Hopyard Rd	Shopping Center	1.0	10,000	10,000	687.2	3.1	SB2B1M210
38	CMC	941 130103700	6670	Owens Dr	Office	1.0	16,225	16,225	571.6	2.6	SB1D3M500
39	Multi-tenant	941 130103800	6668	Owens Dr	Office	1.1	18,730	18,683	680.9	3.1	SB1D3M500
40	Reynolds and Brown	941 130103900	6646	Owens Dr	Office	3.6	26,175	25,346	2,131.3	9.7	SB2B1M501
41	Signature Center Bldg 2	941 130105800	4900	Hopyard Rd	Office	5.2	100,647	96,264	3,184.0	14.5	SB2D1M201
42	Signature Center Bldg 1	941 130105900	5000	Hopyard Rd	Office	5.4	163,962	157,998	3,198.5	14.5	SB2D1M101
43	Reynolds and Brown	941 130106300	6601	Owens Dr	Office	3.2	47,797	45,169	1,885.9	8.6	SB2B1M501
44	Center Park Bldg E	941 130106800	5020	Franklin Dr	Office	1.7	25,535	25,535	1,040.6	4.7	SB2D1M100
45	CM+ Corporation	941 130107200	5200	Franklin Dr	Office	2.7	34,200	34,200	1,573.0	7.2	SB2D1M100
46	Antrim	941 130108200	6155	Stoneridge Dr	Office	1.1	18,600	18,600	666.5	3.0	SB2D1M201
47	6280 W Las Positas Blvd	941 130903402	6280	W Las Positas Blvd	Shopping Center	0.9	13,049	13,049	523.9	2.4	SB3B3M100
48	Allied Brokers/(multi-tenant)	941 130906900	3730	Hopyard Rd	Office	1.2	12,000	10,453	706.4	3.2	SB3B3M100
49	(multi-tenant)	941 131100400	7083	Commerce Cir	Industrial Park	1.0	19,600	19,600	576.4	2.6	SB2A3M200
50	PSSI/StanFast Std Register	941 131100800	7069	Commerce Cir	Industrial Park	0.9	20,800	20,000	553.0	2.5	SB2A3M200
51	(multi-tenant)	941 131100900	7063	Commerce Cir	Industrial Park	1.0	18,120	18,060	598.4	2.7	SB2A3M200
52	Multi-tenant	941 131101500	7039	Commerce Cir	Industrial Park	0.9	20,000	20,000	559.6	2.5	SB2A3M200
53	(multi-tenant)	941 131102400	7074	Commerce Cir	Industrial Park	0.9	20,000	18,144	538.6	2.4	SB2A3M200

Map No.	Development Name	APN	Address No.	Street	Land Use	Area	Gross Area	Usable Area	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)	(SF)[1]		(GPD)[2]		
54	Allied Ecology/Tag's Towing	941 131102600	7066	Commerce Cir	Industrial Park	0.9	22,000	20,000	540.4	2.5	SB2A3M200
55	Church of Christ	941 160000703	11300	Dublin Canyon Rd	Church/Synagogue/Religious	16.2	18,000	18,000	4,473.4	20.3	SZ2B3M302
56	Chabot Center	941 275900600	4637	Chabot Dr	Office	4.0	74,594	72,743	2,455.7	11.2	SB2D2M400
57	Saratoga Center	941 275902000	5934	Gibraltar Dr	Office	5.6	41,700	41,700	3,334.3	15.2	SB2B4M501
58	Quaker Oats	941 275902300	4576	Willow Rd	Office	5.2	45,000	45,000	3,060.0	13.9	SB2D4M505
59	Gateway Square	941 275902800	4877	Hopyard Rd	Shopping Center	9.7	10,000	10,000	5,807.3	26.4	SB2D4M101
60	Prudential California Realty	941 275903101	5960	Stoneridge Dr	Office	2.0	13,571	12,580	1,204.0	5.5	SB2D4M101
61	Crossroads	941 275903400	5990	Stoneridge Dr	Office	0.6	32,260	31,306	369.7	1.7	SB2D4M101
62	Crossroads	941 275903500	5980	Stoneridge Dr	Office	0.7	35,080	33,957	401.1	1.8	SB2D4M101
63	Crossroads	941 275903700	4555	Hopyard Rd	Shopping Center	0.7	33,294	32,807	412.8	1.9	SB2D4M101
64	Office Building (RJA)	941 275904000	4690	Chabot Dr	Office	1.4	20,593	20,593	829.1	3.8	SB2B4M500
65	Las Positas Office Plaza	941 276000500	5994	W Las Positas Blvd	Office	7.4	52,832	52,380	4,251.7	19.3	SB3D2M301
66	Amador Two	941 276000800	4480	Willow Rd	Office	4.8	64,200	63,934	2,830.5	12.9	SB3B2M301
67	Amador I	941 276001000	5925	W Las Positas Blvd	Office	3.5	45,525	45,390	2,055.7	9.3	SB3B4M401
68	Rinconada One	941 276001100	5956	W Las Positas Blvd	Office	6.2	48,501	48,501	3,665.3	16.7	SB3B4M500
69	Arbor	941 276001200	5880	W Las Positas Blvd	Office	6.8	46,175	46,175	4,053.8	18.4	SB3B4M500
70	Sierra I	941 276001500	4464	Willow Rd	Office	4.6	65,628	64,993	2,737.5	12.4	SB3B2M501
71	Hacienda West	941 276001901	3825	Hopyard Rd	Office	14.0	101,488	96,087	8,449.1	38.4	SB3D2M301
72	Associates Center	941 276100403	4301	Hacienda Dr	Office	16.4	299,710	277,562	9,787.8	44.5	SC2C1M300
73	Arroyo Center	941 276201101	5794	W Las Positas Blvd	Office	6.7	53,288	53,288	3,972.2	18.1	SC3A3M300
74	Amador IV	941 276201301	5724	W Las Positas Blvd	Office	4.9	43,000	40,769	2,973.5	13.5	SC3A3M300
75	Hacienda Lakes	941 276201600	4234	Hacienda Dr	Office	15.8	45,000	43,508	9,442.6	42.9	SC3A1M402
76	General Electric	941 276202000	4160	Hacienda Dr	Office	2.7	23,168	23,168	1,617.4	7.4	SC3A1M402
77	Britannia Business Center I	941 276202203	4511	Willow Rd	Office	8.0	65,955	65,765	4,754.5	21.6	SB2D4M303
78	Diablo North	941 276202400	5627	Gibraltar Dr	Office	0.9	34,975	34,975	552.9	2.5	SC3A1M403
79	Hacienda Plaza	941 276300900	5696	Stoneridge Dr	Shopping Center	6.3	6,306	6,306	3,783.5	17.2	SC2C3M201
80	Gibraltar Center II	941 276301601	5731	W Las Positas Blvd	Office	2.8	42,230	42,230	1,693.9	7.7	SC3A3M300
81	Office	941 276400200	5729	W Las Positas Blvd	Office	10.3	4,645	4,645	6,250.6	28.4	SC2D3M501
82	Stoneridge Business Center	941 276400600	5635	W Las Positas Blvd	Office	11.4	19,977	19,848	6,733.5	30.6	SC3B1M102
83	Lincoln Center (Cisco)- Bldg. B	941 277101700	5880	Owens Dr	Office	10.5	119,556	119,556	6,529.4	29.7	SB2B2M100
84	Lincoln Centre (Cisco)- Bldg. A	941 277102800	5860	Owens Dr	Office	4.3	99,600	99,600	2,673.7	12.2	SB2B2M200
85	Metro 580 retail center (Bldg B)	941 277900900	4535	Rosewood Dr	Promotional Center	15.5	25,067	25,067	9,848.8	44.8	SC2B1M100
86		941 278000300				1.9	0	0	1,189.7	5.4	SC2D2M400
86	[multi-tenant svc comm]	941 278000200	3687	Old Santa Rita Rd	Shopping Center	0.6	42,800	42,800	256.1	1.2	SC2D2M400
87	AT&T Center	941 278001901	4420	Rosewood Dr	Office	58.5	173,867	164,387	35,036.9	159.3	SC2B1M400
88		941 278002600				0.2	0	0	147.2	0.7	SC2D2M400
88	[multi-tenant svc comm]	941 278002500	3701	Old Santa Rita Rd	Shopping Center	0.4	6,375	6,375	218.5	1.0	SC2D2M400
89		941 278002800				0.2	0	0	179.7	0.8	SC2D2M400
89	[multi-tenant svc comm]	941 278002700	3715	Old Santa Rita Rd	Shopping Center	0.3	8,000	8,000	204.5	0.9	SC2D2M400
90	Reynolds and Brown	941 281700100	5165	Johnson Dr	Office	0.9	12,694	12,694	4,568.3	20.8	SB2B1M501
91	Reynolds and Brown	941 281700500	6685	Owens Dr	Office	2.1	25,964	25,964	2,001.2	9.1	SB1D3M500
92	Acura of Pleasanton	946 110003102	3830	Old Santa Rita Rd	Auto Dealer	1.0	2,125	2,125	589.7	2.7	SC2D2M400
93	Rose Pavilion multi-tenant/Ph III	946 110003402	4240	Rosewood Dr	Shopping Center	3.3	3,840	3,840	1,936.1	8.8	SD2A3M200
94	Rose Pavilion multi-tenant/Ph II	946 110003700	4001	Santa Rita Rd	Shopping Center	1.4	14,860	14,860	819.4	3.7	SD2A3M200
95	Rose Pavilion multi-tenant/Ph I	946 110003800	4211	Rosewood Dr	Shopping Center	1.1	14,050	14,050	757.9	3.4	SD2A3M200
96	Rose Pavilion multi-tenant/Ph I	946 110004502	4247	Rosewood Dr	Shopping Center	1.6	10,833	10,833	2,094.3	9.5	SD2A3M200
97	Exstg Kaiser/ K1 & K2	946 125000600	3000	Busch Rd	Gravel Processing	107.0	75,000	75,000	63,044.1	286.6	SD4B1M402
98	(multi-tenant)	946 168007100	39	California Ave	Industrial Park	1.5	42,664	39,683	824.1	3.7	SD4D3M201
99	Cafe Dansk/pet groomer/lawn mower	946 169100600	4290	Stanley Blvd	Shopping Center	0.4	3,000	3,000	225.1	1.0	SD5A1M203
100	Pleasanton Auto Body/V&G Muffler	946 169101000	4262	Stanley Blvd	Auto Care Center	0.4	5,580	5,580	222.8	1.0	SD5A1M203
101	Vintage Hills Center	946 255109000	3500	Bernal Ave	Neighborhood Shopping Center	5.1	46,915	46,915	3,016.9	13.7	SD5D2M102
102	20-24 Happy Valley Rd (multi-ten)	946 305201700	20	Happy Valley Rd	Office	0.7	20,966	20,966	482.5	2.2	SC7C2M400
103	(medical offices)	946 336701200	1475	Cedarwood Ln	Medical Office	0.5	4,865	4,865	291.1	1.3	SD4C1M201

Vacant Existing COI
Revised December 18, 2003

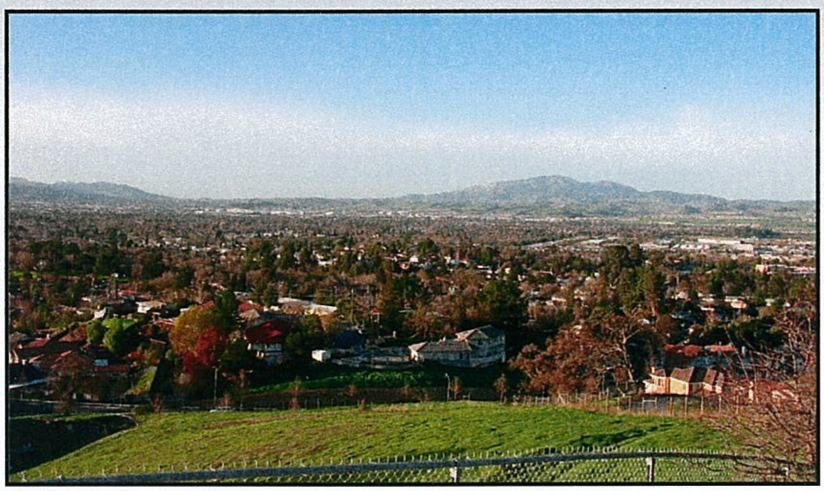
Map No.	Development Name	APN	Address No.	Street	Land Use	Area	Gross Area	Usable Area	Projected Flow	DUE[3]	Projected Model Flow Input Manhole
						(Acres)	(SF)[1]		(GPD)[2]		
104	1393 Santa Rita medical offices	946 336702301	1393	Santa Rita Rd	Medical Office	0.8	8,474	8,474	478.1	2.2	SD4C1M201
105	(multi-tenant)	946 338000700	4460	Black Ave	Office	1.0	12,000	12,000	554.4	2.5	SC4D2M204
106	(multi-tenant)	946 338001000	4456	Black Ave	Office	0.5	5,760	5,760	318.0	1.4	SC4D2M204
107	ASK Associates	946 454707400	1024	Serpentine Ln	Industrial Park	1.3	18,005	18,005	772.8	3.5	SD4C4S207
108	(multi-tenant)	946 454708300	1228	Quarry Ln	Industrial Park	1.1	15,840	15,840	614.6	2.8	SD4C4S207
109	Mutlitenant	946 454709400	1244	Quarry Ln	Industrial Park	1.2	17,411	17,411	716.8	3.3	SD4C4S207
110	(multi-tenant)	946 454709700	1020	Serpentine Ln	Industrial Park	1.3	18,100	18,032	791.0	3.6	SD4C4S207
111	Balch Enterprises	946 454709800	1279	Quarry Ln	Industrial Park	2.7	36,107	36,107	1,638.6	7.4	SD4C4S207
112	Koll/Quarry Business Center (4)	946 454710001	1257	Quarry Ln	Office	5.1	16,640	16,640	3,035.6	13.8	SD4C4S207
113	Valley Four	946 454710400	1177	Quarry Ln	Industrial Park	3.7	30,240	30,240	2,180.6	9.9	SD4C4S207
114	Balch Business Ctr I (Bldg 2)	946 454711600	1048	Serpentine Ln	Industrial Park	1.3	20,480	20,480	743.0	3.4	SD4C4S207
115	1065 Serpentine Ln - Suite 4	946 454715600	1065	Serpentine Ln	Industrial Park	0.2	7,781	7,781	106.0	0.5	SD4C4M406
116	3958 Valley Ave - Suite B	946 454717100	3958	Valley Ave	Industrial Park	0.0	2,306	2,306	28.3	0.1	SD4C4S207
117	3942 Valley Ave - Suite N	946 454718000	3942	Valley Ave	Industrial Park	0.0	1,920	1,920	25.4	0.1	SD4C4S207
118	3942 Valley Ave - Suite J	946 454718400	3942	Valley Ave	Industrial Park	0.1	2,592	2,592	32.6	0.1	SD4C4S207
119	3942 Valley Ave - Suite I	946 454718500	3942	Valley Ave	Industrial Park	0.1	2,592	2,592	36.3	0.2	SD4C4S207
120	1059 Serpentine Ln - Suite B	946 454721700	1059	Serpentine Ln	Industrial Park	0.2	9,600	9,600	130.8	0.6	SD4C4S207
121	1061 Serpentine Ln - Suite B	946 454721900	1061	Serpentine Ln	Industrial Park	0.1	2,805	2,805	42.5	0.2	SD4C4S207
122	1063 Serpentine Ln - Suite E-2	946 454722600	1063	Serpentine Ln	Industrial Park	0.1	5,347	5,347	72.6	0.3	SD4C4S207
123	Panattoni - Building 3, Suite B	946 454723700	500	Boulder Ct	Industrial Park	0.4	15,000	15,000	267.2	1.2	SD4C4S207
124	(multi-tenant)	946 455001100	2134	Rheem Dr	Industrial Park	0.9	12,864	12,864	514.7	2.3	SD3A3M300
125	(multi-tenant)	946 455001901	4125	Mohr Ave	Office	1.6	18,709	18,709	814.4	3.7	SD3C1M401
126	(multi-tenant)	946 455002100	2340	Santa Rita Rd	Office	1.0	12,807	12,807	591.1	2.7	SD3C1M401
127	Sta Rita Ind Ctr (Bldg 1)	946 455002700	2182	Rheem Dr	Industrial Park	0.2	8,705	8,705	117.7	0.5	SD3A3M100
128	Sta Rita Offc Ctr (1)	946 455003200	4463	Stoneridge Dr	Office	0.1	4,608	4,608	70.1	0.3	SC3B2M313
129	North Creek I	946 455701600	7026	Koll Center Pkwy	Office	12.2	21,600	21,600	7,013.9	31.9	SB5B4M501
130	Magnolia Court	946 455701800	7139	Koll Center Pkwy	Office	1.6	19,679	19,679	954.1	4.3	SB5B4M400
131	Magnolia Court West	946 455701900	7133	Koll Center Pkwy	Office	2.7	29,183	29,183	1,678.2	7.6	SB5B4M400
132	Sycamore Terrace	946 455702003	6601	Koll Center Pkwy	Office	4.4	71,710	69,588	2,626.8	11.9	SB5D2M401
133	North Creek II	946 455702400	6920	Koll Center Pkwy	Office	9.3	45,364	45,364	5,409.0	24.6	SB5D1M201
134	Bernal Plaza	946 455702902	6654	Koll Center Pkwy	Shopping Center	4.2	37,800	35,721	2,666.5	12.1	SB5D2M401
135	Koll 2-story office bldg	946 455703400	7180	Koll Center Pkwy	Office	1.4	40,088	40,088	822.4	3.7	SB5B4M400
136	Birch Lakes	946 455703700	7011	Koll Center Pkwy	Office	9.2	48,354	48,354	5,325.9	24.2	SB5D1M103
137	Parkway Properties	946 455703800	6800	Koll Center Pkwy	Office	6.0	111,250	108,564	3,647.9	16.6	SB5D2M501
138	Parkway Properties	946 455703900	6700	Koll Center Pkwy	Office	6.0	111,250	108,564	3,561.4	16.2	SB5D4M100
139	Sycamore Plaza II	946 455704100	6701	Koll Center Pkwy	Office	6.5	126,173	123,063	3,880.0	17.6	SB5D2M401
140	Creanova	947 000400211	5555	Sunol Blvd	Warehouse	8.5	129,150	129,150	5,199.5	23.6	SC6D2M502
141	Sunol Office Park (Phase I)	948 000802600	5510	Sunol Blvd	Office	0.5	5,220	5,220	294.5	1.3	SC6D2M200
142	Oak Hills ctr (Bldg 2)	948 000807200	5424	Sunol Blvd	Neighborhood Shopping Center	9.1	17,050	17,050	5,435.3	24.7	SC6B4M200
143	(multi-tenant)	948 000900600	5671	Sonoma Dr	Industrial Park	0.5	7,999	7,689	329.2	1.5	SC6D2M104
144	(multi-tenant)	948 000900900	5776	Sonoma Dr	Industrial Park	0.5	6,950	6,950	288.2	1.3	SC6D2M502
145	(multi-tenant)	948 000901000	5750	Sonoma Dr	Industrial Park	0.5	6,950	6,950	284.7	1.3	SC6D2M502
146	Antrim MT Bldg	948 000901600	5600	Sunol Blvd	Industrial Park	0.3	7,949	7,949	173.1	0.8	SC6D2M502
Total						**639.2**	**5,847,859**	**5,736,688**	**381,783.5**	**1,735.4**	

Notes:
(1) SF = Square Feet
(2) GPD = Gallons per day
(3) DUE = Dwelling Unit Equivalent = 220 GPD

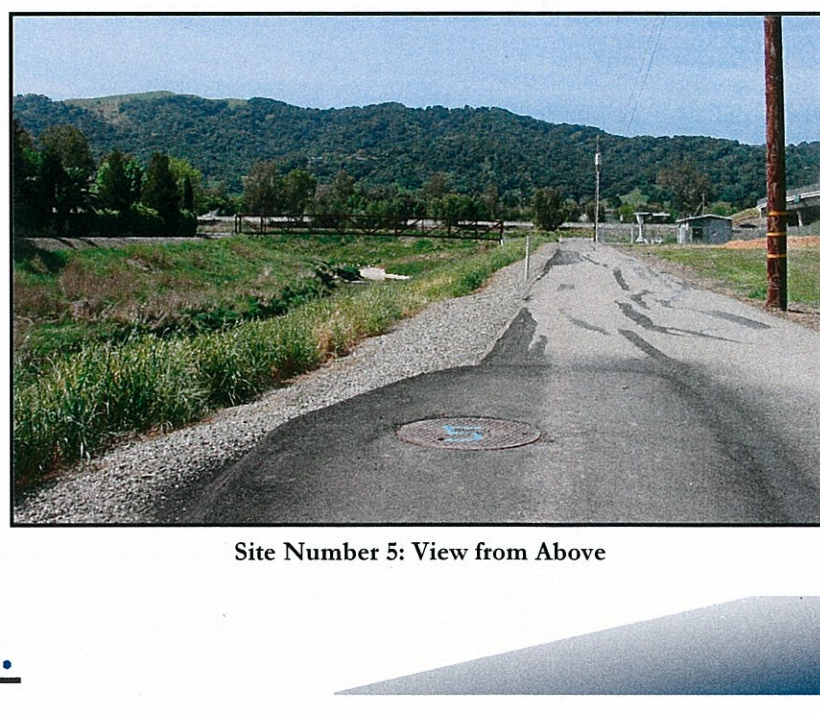
APPENDIX C - V&A FLOW MONITORING REPORT

Sanitary Sewer Flow Monitoring Study

April, 2004



View of Pleasanton from Water Tank



Site Number 5: View from Above

V&A CONSULTING ENGINEERS, INC.

CITY OF PLEASANTON

SANITARY SEWER

FLOW MONITORING REPORT

Prepared for:

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7580 N. Ingram Avenue
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Prepared By:

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Lake Merritt Plaza
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April, 2004

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) has completed sanitary sewer flow monitoring and inflow and infiltration (I/I) analysis within the City of Pleasanton (City). Flow monitoring was conducted over a 4-week period from January 31, 2004 through February 29, 2004 at 11 flow monitoring sites, chosen by Carollo Engineers (Carollo) to best model five basins and multiple sub-basins within the City collection system. The 11 flow monitoring sites, five basins, and additional sub-basins are shown in Figure 1 on Page 4 of this report. Basins 6 and 7 were not monitored as a part of this project.

Table 1 summarizes the basin and sub-basin data based on the flow monitoring, rainfall monitoring, and I/I analysis that occurred during this study. Table 1 includes the R-Values[1], peaking factor (PF)[2], and d/D Ratios[3] calculated for each basin or sub-basin. Values that exceeded commonly used threshold values are shown in red.

Table 1. Summary of Findings

Threshold Values: R-Value > 5%, PF > 3.0, d/D > 0.75

Basin No.	ADWF (MGD)	All Storm Events		R-Value Ranking Within Basin	R-Value Overall Ranking	Peak I/I Flow (MGD)	Peak Flow (MGD)	PF	d/D Ratio
		Total I/I (MGal)	Overall R-Value						
1	**0.68**	**1.45**	**0.8%**	-	7	**1.83**	**2.64**	**3.91**	**1.36**
2	**1.56**	**3.16**	**1.0%**	-	-	**2.99**	**4.72**	**3.03**	**1.15**
2a	*0.70*	*0.15*	*0.1%*	2	11				
2b	*0.85*	*3.01*	*1.5%*	1	2	*1.69*	*2.91*	*3.41*	*0.39*
3	**1.11**	**2.23**	**0.8%**	-	-	**1.83**	**3.44**	**3.09**	**0.55**
3a	*0.26*	*1.35*	*1.9%*	1	1				
3b	*0.23*	*0.62*	*0.5%*	2	8	*0.51*	*0.75*	*3.34*	*0.43*
3c	*0.63*	*0.25*	*0.4%*	3	9	*0.30*	*1.38*	*2.20*	*0.68*
4	**0.95**	**0.92**	**0.6%**	-	-	**1.28**	**2.09**	**2.19**	**0.46**
4a+4b+4c	*0.46*	*0.14*	*0.3%*	2	10				
4d	*0.49*	*0.95*	*1.3%*	1	4	*0.51*	*1.32*	*2.69*	*0.52*
5	**1.02**	**2.43**	**1.1%**	-	-	**1.22**	**2.49**	**2.44**	**0.34**
5a+5b+5c	*0.07*	*0.52*	*0.8%*	3	6				
5d	*0.53*	*1.06*	*1.2%*	2	5				
5e	*0.41*	*0.86*	*1.4%*	1	3	*0.54*	*1.08*	*2.62*	*0.39*

**I/I = Infiltration and Inflow (defined on Page 11)*
Cells shaded in GRAY indicate basins that were not directly monitored thus, peak flows and flow depths cannot be accurately stated.

[1] R-Value is the percentage of rainfall that permeates into the sewer system. Sewer Basins with R-Values<5% are often considered to be performing well. Keefe, P.N. "Test Basins for I/I Reduction and SSO Elimination", 1998, WEF Wet Weather Specialty Conference, Cleveland, Ohio.

[2] Peaking Factor is the Peak Wet Weather Flow divided by the Average Dry Weather Flow and is a good indicator of inflow into a collection basin. Peaking factors below 3.0 are commonly used for design purposes.

[3] d/D is the peak depth of flow divided by the pipe diameter. d/D < 0.75 is a commonly used for pipe design parameter.

- No basins or sub-basins exceeded 5% infiltration/inflow into their sewerage basin.
    - Most I/I flow within Basin 2 originates from Sub-basin 2b.
    - Most I/I flow within Basin 3 originates from Sub-basin 3a.
    - Most I/I flow within Basin 4 originates from Sub-basin 4d.
    - I/I Flow within Basin 5 is relatively equal amongst the sub-basins.
- Basins 1, 2 and 3, and Sub-basins 2b and 3b (sub-basin) exceeded a Peaking Factor of 3.0. It is noted that the monitoring sites for Basins 1 and 2 were located very close to the treatment facility, and peak flows may have been influenced by plant operation procedures and backflow conditions.
- At the flow monitoring sites for Basins 1 and 2, the d/D ratio exceeded 0.75. It is noted that these sites were located very close to the treatment facility, and the high depths of flow may have been influenced by plant operation procedures and backflow conditions.
- The City of Pleasanton collection system does not appear to have high levels of ground water infiltration.

In general, the City of Pleasanton collection system is performing well in terms of I/I. Further action and investigation taken to reduce I/I within the collection system should commence with Basins 2b and 3a, and then be prioritized per the overall rankings shown in Table 1.

Given the lower volumes of I/I flow into the collection system, it is recommended that the City consider conducing a study to determine which is more cost-effective: (1) locating the sources of infiltration and inflow and systematically rehabilitating or replacing the faulty pipelines; or (2) continued treatment of the additional storm water I/I flow. Future CCTV inspection as used for condition assessment of the collection system should be prioritized per the overall rankings shown in Table 1. The City may consider reviewing the operational levels of wastewater flow through the treatment plant to determine if any modifications can be made to improve the d/D values of the pipes nearest the treatment facility.

INTRODUCTION

V&A was retained by Carollo to conduct sanitary sewer flow monitoring within the City of Pleasanton to assist with the study of infiltration and inflow (I/I). The scope of work includes the following tasks:

- Install flow monitoring equipment at 11 monitoring sites. Flow data shall be recorded at 15-minute intervals.
- Install rain gauges at three locations.
- Conduct I/I analysis to differentiate base flows from I/I flows for the sites monitored.
- Prepare a report summarizing the findings of the flow monitoring and I/I analysis..

Initial site locations were proposed by Carollo and then reviewed and field evaluated by V&A to achieve the most ideal flow conditions for reliable data collection. The following modifications were made to the flow monitoring sites initially proposed by Carollo:

- Meter 2 was installed one manhole downstream (SB3A1M303) from the original proposed manhole location (SB3A2M301) in order to minimize disruption to neighborhood residents.
- Meter 3 was installed one manhole upstream (SC2C4M400) from the original proposed manhole location (SC2C3M503) to improve accessibility to the site.
- Meter 5 was relocated on February 17, 2004 to the third manhole upstream from the original installed manhole (SB3C4M401). The meter was relocated to minimize the backflow conditions that were occurring due to the influence of the pump station directly downstream.
- Meter 9 was relocated one manhole downstream (SB5D4M400) from the original proposed manhole location (SB5D3M505) to minimize traffic impacts.

Figure 1 shows a general site map of the project area and of the flow monitoring locations and rain gauge locations. The basins that correspond to the monitoring sites are color-shaded. Detailed descriptions of the flow monitoring sites, including photographs and detailed maps, are included in the Appendices.

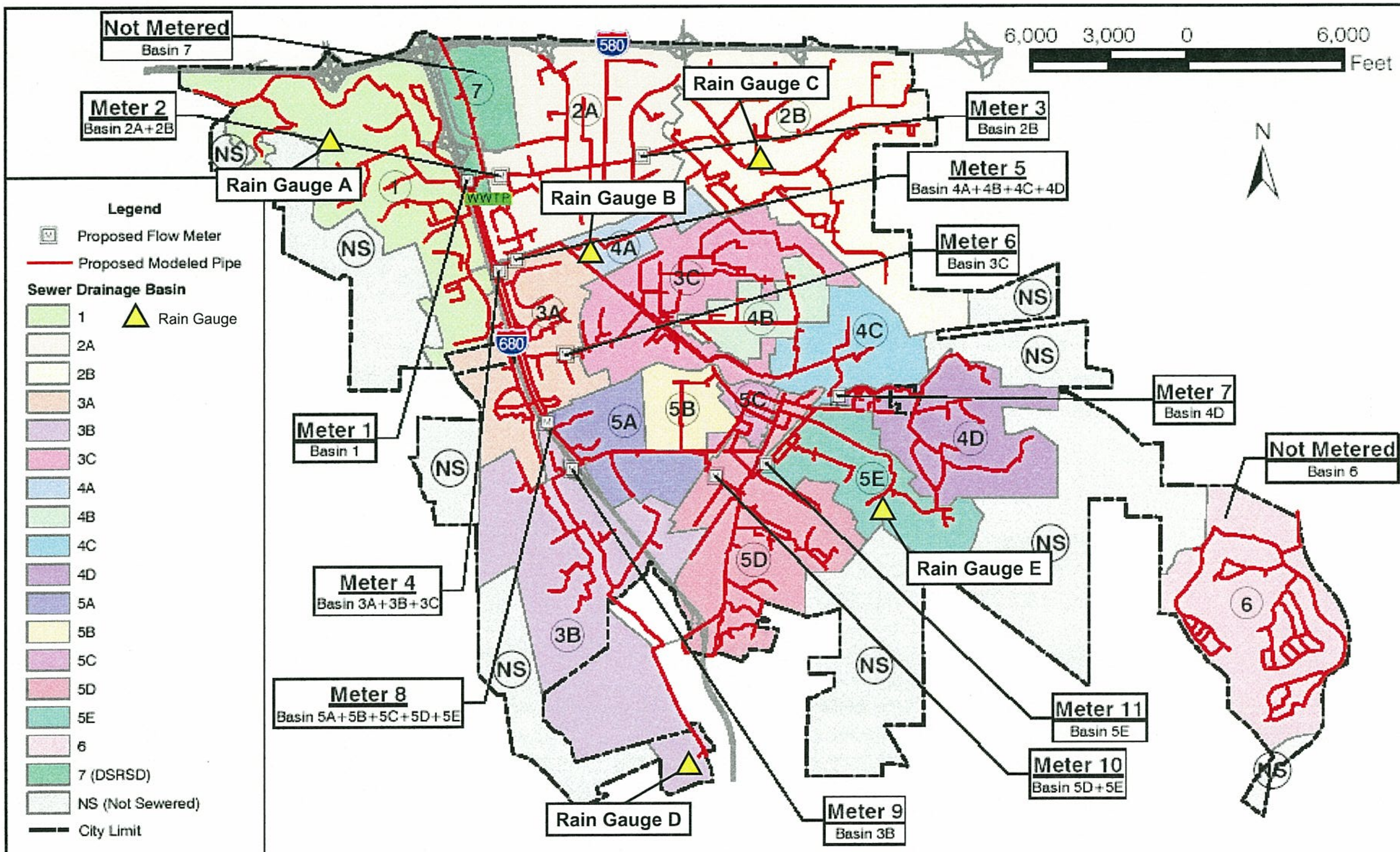
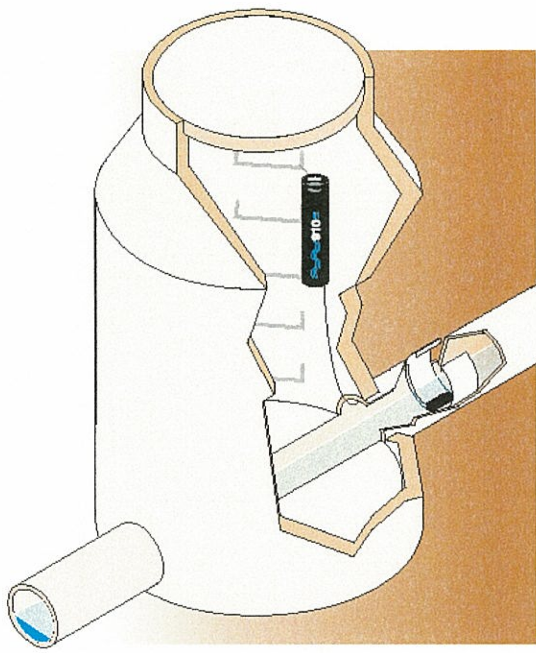


Figure 1. Flow Monitoring and Rain Gauge Locations

METHODS AND PROCEDURES

Meter Installation

Eleven Sigma 910 flow meters were installed by V&A in the sewer lines shown in Figure 1. Sigma meters use a pressure transducer to collect depth readings, and ultrasonic Doppler sensors on the probe to determine the average fluid velocity. Figure 2 shows a sketch of a typical flow meter installation.



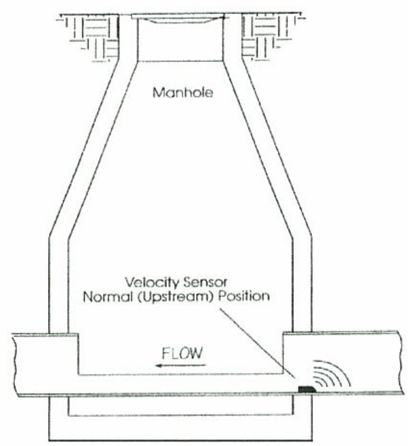


Figure 2. Flow Meter Installation

Continuous depth and velocity readings were recorded by the flow meters in 15-minute increments and downloaded into a computer spreadsheet program where the data could be analyzed and made report ready. Manual level and velocity readings were taken in the field during the flow meter installation and again when removed, and compared to the readings of the flow meters to ensure proper calibration and accuracy.

Explanation of Report Graphs and Definition of Terms

Flow versus time graphs are created by interpolating the data recorded by the flow meter in 15-minute intervals, and represent the **diurnal flow curve** recorded over a given monitoring period. These graphs represent the data in its rawest form. Figure 3 shows a typical diurnal flow curve and identified on this graph are the hypothetical **peak**, **low**, and **average** flows recorded over an example monitoring period. These graphs are useful in identifying the extreme limits of the flows being monitored, and spotting any trends that might be occurring at a particular site.

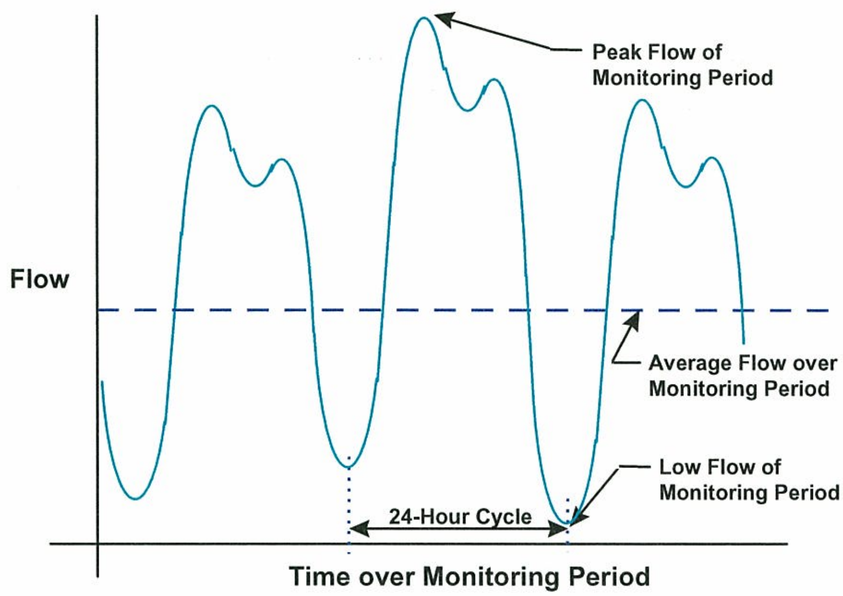


Figure 3. Diagram of Hypothetical Diurnal Flow over Monitoring Period

The data recorded within the flow monitoring period is considered to be a combination of dry weather and wet weather flow. Dry weather flow is the flow that is caused by actual waste drainage from buildings in the area. Wet weather flow includes infiltration and inflow dependent on rainfall.

RAINFALL RESULTS

Three rain gauges were installed on January 31, 2004 within the City of Pleasanton to compliment two existing rain gauges to record rainfall events over the flow monitoring period (see Figure 1 for gauge locations). The rainfall season has been categorized into three main storm events, shown in Table 2. Figure 4 graphically displays the three storm events.

Table 2. Summary of Storm Events

Event No.	Rain A (inch)	Rain B (inch)	Rain C (inch)	Rain D (inch)	Rain E (inch)	Event Period	Event Description	Estimated Soil Condition
E1	1.34	1.36	1.36	1.38	1.42	**1.0 Days** 2/2 9:00 to 2/3 8:00	Strong 2-hour high intensity rainfall followed by light intensity rainfall.	Lightly saturated: Sparse rainfall since 1/1/04.
E2	1.25	0.77	0.53	1.28	1.18	**18 Hours** 2/17 16:00 to 2/18 9:00	Moderate and consistent intensity rainfall for 18 hours.	Lightly saturated.
E3	2.45	0.99	1.06	1.92	1.63	**1.9 Days** 2/25 6:00 to 2/27 4:00	Intermittent short duration bursts between light intensity rainfall.	Moderately saturated.

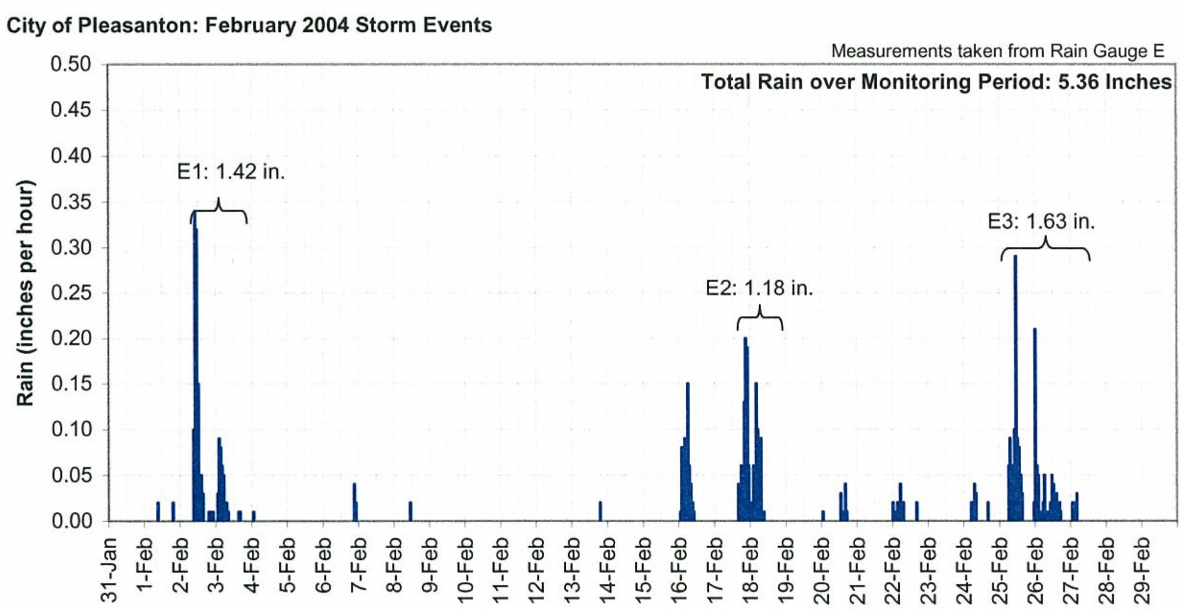


Figure 4. City of Pacific Grove Rainfall Events over Flow Monitoring Period

Figure 5 shows the rain accumulation plot of each of the five rain gauges, as well as the historical average rainfall for Pleasanton during this project duration. Also shown for comparison, and as an added measure of QA/QC, are two additional NOAA weather stations within the Livermore area[4].

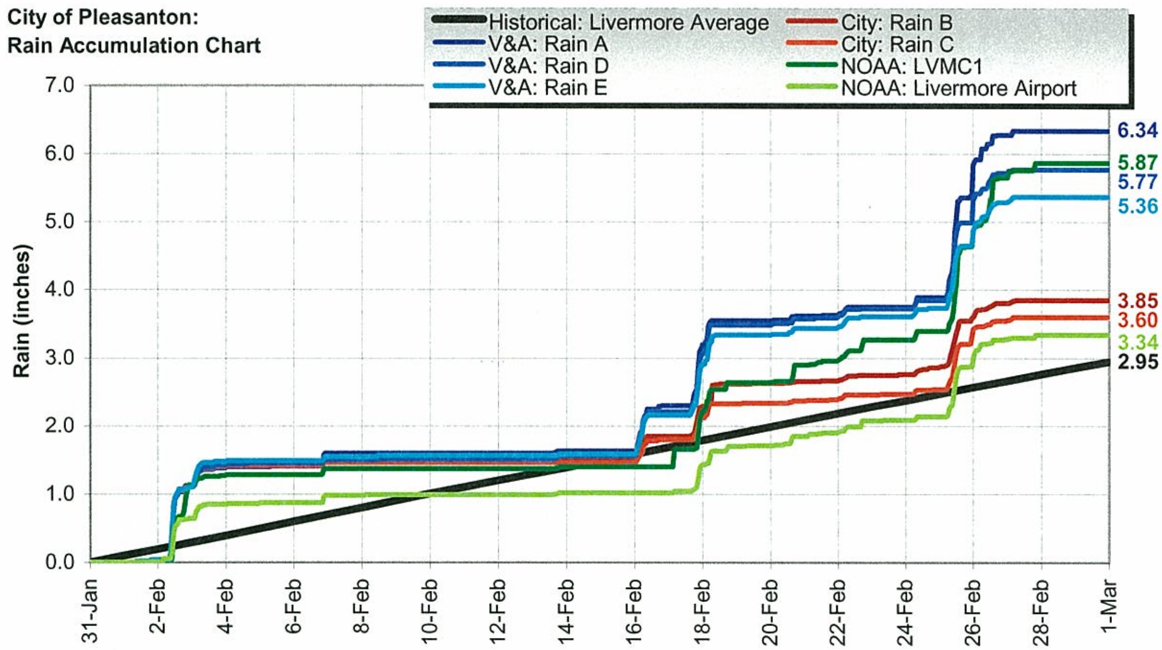


Figure 5. Rainfall Accumulation Plots

The historical average rainfall is shown for comparison to the rainfall that occurred over the course of the flow monitoring period (January 31, 2004 through March 1, 2004). The historical data was taken from the Western Regional Climate Center (WRCC) at Station 044997 in Livermore, California. Rainfall data from the years 1971 through 2000 were used to determine these averages. The historical average from January 31 through March 1 is 2.95 inches. All rain gauges indicated rainfall totals above normal levels, but ranging from 3.34 to 6.34 inches over the flow monitoring period, indicating that the topography of Pleasanton had a marked effect on the volume of rainfall. Thus, the rainfall attributed to each basin must be calculated based on the proximity to the rain gauge locations. The rain gauge distribution is shown in Table 3.

[4] Data available from the National Oceanic and Atmospheric Administration (NOAA) was downloaded to verify the integrity of the data from the three installed meters. It is noted that the data from their website has not been quality controlled. The NOAA rainfall data at sites located in Livermore (LVMC1) and at the Livermore Airport (LVC) can be found at: <http://precip.fsl.noaa.gov/hourly_precip.html>.

Table 3. Rain Gauge Distribution to Basins

Basin	Rain Gauge A	Rain Gauge B	Rain Gauge C	Rain Gauge D	Rain Gauge E
1	100%				
2a	20%		45%	35%	
2b				100%	
3a	30%		50%		20%
3b		100%			
3c			100%		
4a			100%		
4b			60%		40%
4c			40%		60%
4d			25%		75%
5a		35%	65%		
5b			55%		45%
5c			45%		55%
5d		35%	20%		45%
5e					100%

RESULTS

Flow Monitoring Sites and Isolation Basin Definition

The 11 flow meters were strategically placed to obtain flows from the five basins, and to allow for the isolation of many of the sub-basins with the collection system. Please refer to Figure 1 for the locations of the flow monitoring sites and basins. Table 4 summarizes the individual basin information. Please note that to isolate particular sub-basins, a subtraction of flows is required. Sub-basins which require a subtraction of flows can accurately calculate totalized data (such as total I/I flow, or average daily flow), but will not allow for the accurate calculation of real-time data (such as instantaneous peak flows).

Table 4. Basin Details and Information

Basin No.	Basin Flow Formula	Area[5] (sq. miles)	Description
1	M1*	**2.14**	Primarily residential flow
2	M2	**4.25**	Combination residential and commercial flow
2a	M2 – M3	1.81	
2b	M3	2.44	
3	M4	**4.73**	Primarily residential flow
3a	M4 – M6 – M9	1.08	
3b	M9	2.35	
3c	M6	1.30	
4	M5	**2.40**	Combination residential and commercial flow
4a+4b+4c	M5 – M7	1.33	
4d	M7	1.08	
5	M8	**3.35**	Combination residential and commercial flow
5a+5b+5c	M8 – M10	1.10	
5d	M10 – M11	1.42	
5e	M11	0.83	

** M1 = Meter 1*

[5] Areas were determined by tracing the boundary lines in AutoCAD to scale and using a built-in function to compute the area. Areas should be considered to be approximate.

Dry Weather Flow Results

Weekday and weekend flow patterns vary and must be separated when determining average dry weather flows. For this project, the following days were least affected by rainfall and used to determine weekend and weekday average flows:

- Weekdays: February 4, 5, 9, 10, 11, 12, 13
- Weekends: February 1, 7, 8, 14, 15

Figure 6 shows a sample of the average dry weather flow graph that was generated for each flow monitoring site and are located in the Appendix section.

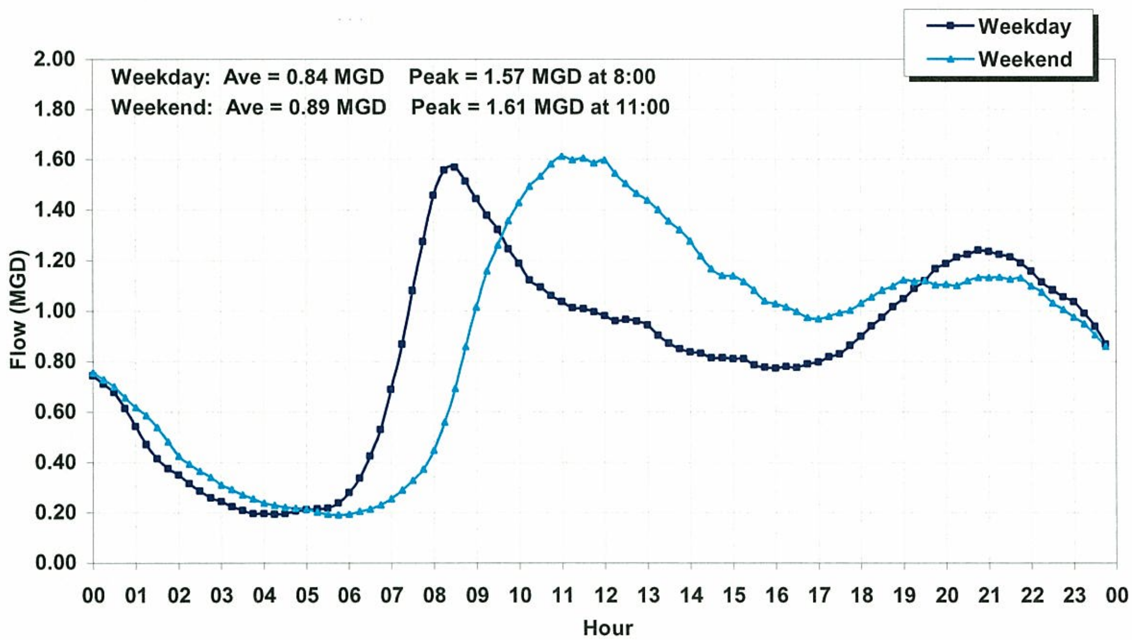


Figure 6. Basin 2b: Average Dry Weather Flow

Table 5 lists the average dry weather flow (ADWF) and average peak dry weather flows (PDWF) recorded during this study.

Table 5. Basin Dry Weather Flows

Basin No.	Average Dry Weather Flow (MGD)	Average Peak Dry Weather Flow (MGD)	PDWF/ADWF Ratio
1	**0.68**	**1.17**	**1.73**
2	**1.56**	**2.58**	**1.65**
2a	*0.70*		
2b	*0.85*	*1.65*	*1.93*
3	**1.11**	**2.28**	**2.05**
3a	*0.26*		
3b	*0.23*	*0.40*	*1.78*
3c	*0.63*	*1.15*	*1.84*
4	**0.95**	**1.81**	**1.90**
4a+4b+4c	*0.46*		
4d	*0.49*	*1.00*	*2.03*
5	**1.02**	**1.71**	**1.67**
5a+5b+5c	*0.07*		
5d	*0.53*		
5e	*0.41*	*0.76*	*1.83*
Sum of Basins:	**5.32**		

Cells shaded in GRAY indicate basins that were not directly monitored.

Figure 7 illustrates the distribution of Baseline Flows by collection basin.

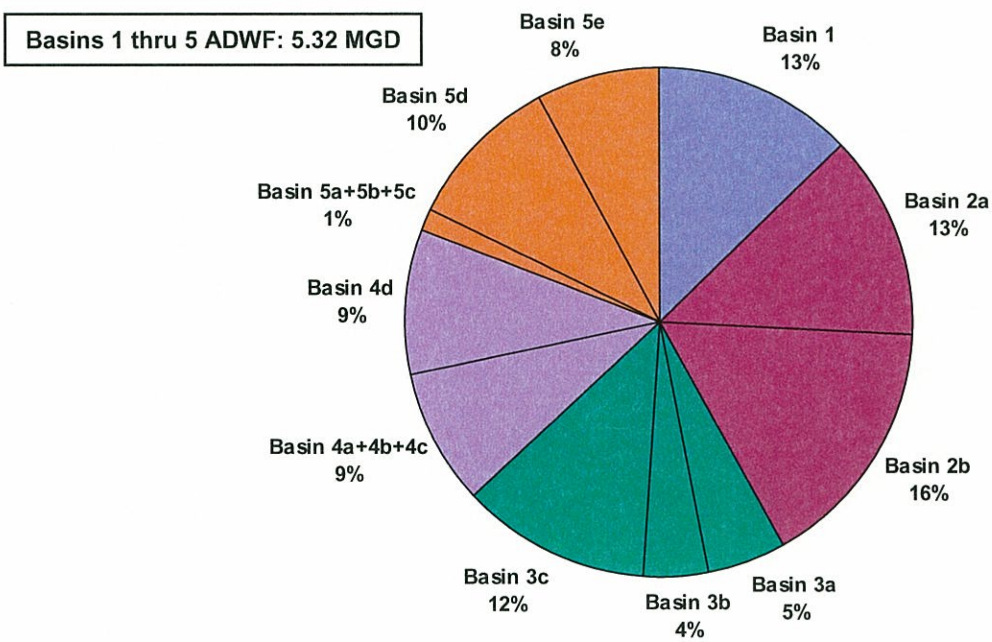


Figure 7. Pie Chart: Average Dry Weather Flows by Basin

Wet Weather Flow Results and I/I Analysis

I/I Preface

Wet weather flow is the combination of dry weather flow (Baseline Flow) with additional flows that enter the system during times of wet weather. The additional flow is called infiltration/inflow (I/I) and is calculated by subtracting the pre-determined dry weather flow from the real-time monitored flow. During a storm event, additional flow over the expected dry weather flow is considered I/I.

Infiltration sources are often defects in deteriorated sewer pipes and may include cracks, offset joints, root intrusion points, and broken pipes. Groundwater or rainwater in the vicinity typically enters the pipelines through these defects. Groundwater infiltration (GWI) depends on the depth of the groundwater table above the pipelines as well as the percentage of the system submerged, but is usually very steady and consistent. Rainfall dependent infiltration (RDI) is more significantly influenced by the size and duration of the storm event. Infiltration is often recognized graphically by a gradual increase in flow after a wet weather event. The increased flow typically sustains for a short period after rainfall has stopped and then gradually drops off.

Compared to infiltration sources, storm water inflow (SWI) locations are relatively easy to find and usually less expensive to correct. These sources include direct and indirect cross connections with storm drainage systems, roof downspouts, and various types of surface drains. Inflow is usually recognized graphically by large magnitude, short duration spikes immediately following a rain event.

Figure 8 illustrates the components of I/I, and how they may be recognized graphically.

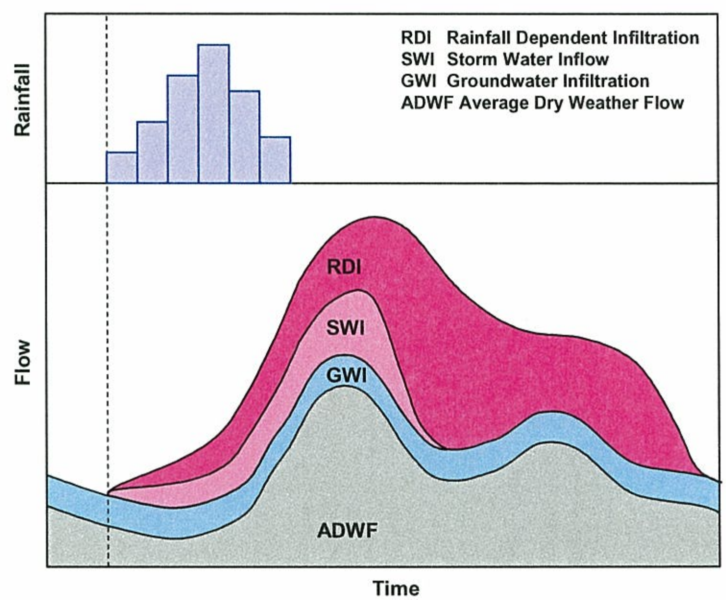


Figure 8. Infiltration /Inflow Components

I/I Analysis

Realtime flow was plotted against the baseline flow and the hourly rainfall data to determine the I/I flow volume during each storm event, as shown below in Figure 9 for Basin 2b and Storm Event 1. Similar graphs were generated for each storm event and are located in the Appendix.

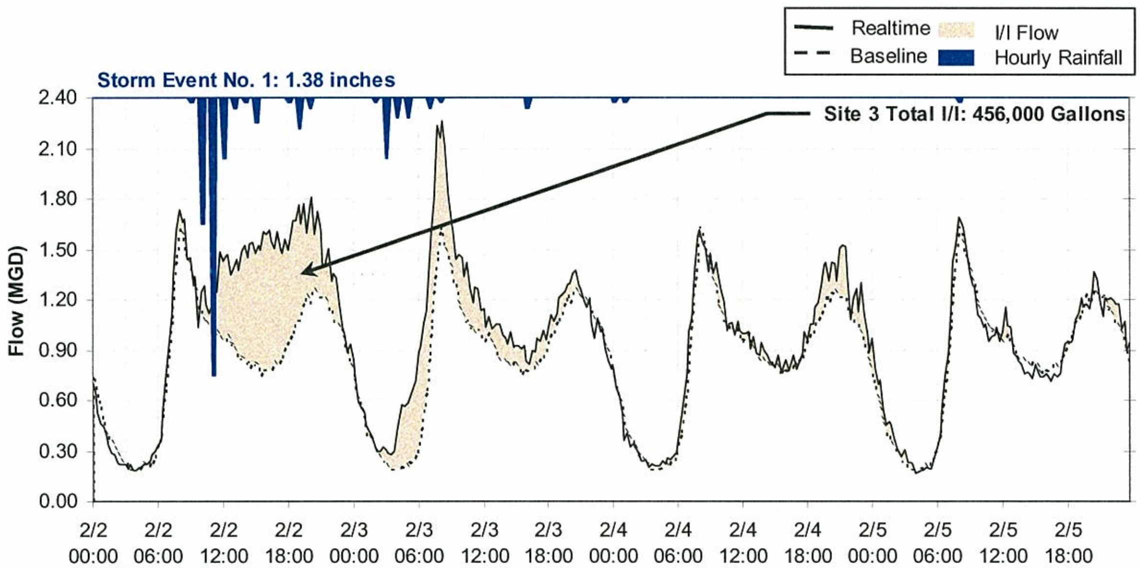


Figure 9. Basin 2b: Storm Event 1 I/I Flow

With the basin areas, the percentage of rainfall that permeates into each basin can calculated and is called the R-Value. The R-Value method provides a means to compare the relative magnitude and severity of I/I flow between different basins. Systems with R-Values less than 5%[6] are often considered to be performing well and this criterion will be used for this study.

Peaking Factor is defined as the Peak Wet Weather Flow divided by the Average Dry Weather Flow. Peaking factors can be used to determine the extent of the inflow component of I/I within a particular basin. A peaking factor threshold value of 3.0 is commonly used for sanitary sewer design.

The d/D ratio is the peak measured depth of flow divided by the pipe diameter. A d/D ratio less than 0.75 is a common threshold value used for pipe design.

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[6] Keefe, P.N. "Test Basins for I/I Reduction and SSO Elimination", 1998, WEF Wet Weather Specialty Conference, Cleveland, Ohio.

Table 6 summarizes the I/I data collected for this study. Values which exceed threshold criterion values are highlighted in red.

Table 6. Basin and Sub-Basin I/I Summary

Threshold Values: R-Value > 5%, PF > 3.0, d/D > 0.75

Basin No.	ADWF (MGD)	Storm Event 1		Storm Event 2		Storm Event 3		Peak I/I Flow (MGD)	Peak Flow (MGD)	PF	d/D Ratio
		Total I/I (MGal)	R-Value (%)	Total I/I (MGal)	R-Value (%)	Total I/I (MGal)	R-Value (%)				
1	**0.68**	**0.18**	**0.4%**	**0.17**	**0.4%**	**1.10**	**1.2%**	**1.83**	**2.64**	**3.91**	**1.36**
2	**1.56**	**0.56**	**0.6%**	**0.75**	**0.9%**	**1.84**	**1.4%**	**2.99**	**4.72**	**3.03**	**1.15**
2a	*0.70*	*0.11*	*0.2%*	*0.01*	*0.0%*	*0.03*	*0.1%*				
2b	*0.85*	*0.46*	*0.8%*	*0.74*	*1.4%*	*1.81*	*2.2%*	*1.69*	*2.91*	*3.41*	*0.39*
3	**1.11**	**0.39**	**0.3%**	**0.60**	**0.1%**	**1.24**	**1.3%**	**1.83**	**3.44**	**3.09**	**0.55**
3a	*0.26*	*0.20*	*0.8%*	*0.41*	*2.5%*	*0.74*	*2.5%*				
3b	*0.23*	*0.13*	*0.2%*	*0.12*	*0.4%*	*0.38*	*0.9%*	*0.51*	*0.75*	*3.34*	*0.43*
3c	*0.63*	*0.06*	*0.2%*	*0.07*	*0.6%*	*0.12*	*0.5%*	*0.30*	*1.38*	*2.20*	*0.68*
4	**0.95**			**0.21**	**0.6%**	**0.61**	**1.1%**	**1.28**	**2.09**	**2.19**	**0.46**
4a+4b+4c	*0.46*			*0.01*	*0.0%*	*0.14*	*0.5%*				
4d	*0.49*	*0.28*	*1.0%*	*0.20*	*1.1%*	*0.47*	*1.7%*	*0.51*	*1.32*	*2.69*	*0.52*
5	**1.02**	**0.54**	**0.7%**	**0.65**	**1.2%**	**1.24**	**1.6%**	**1.22**	**2.49**	**2.44**	**0.34**
5a+5b+5c	*0.07*	*0.10*	*0.4%*	*0.21*	*1.5%*	*0.21*	*1.0%*				
5d	*0.53*	*0.32*	*0.9%*	*0.34*	*1.5%*	*0.40*	*1.2%*				
5e	*0.41*	*0.12*	*0.6%*	*0.11*	*0.6%*	*0.63*	*2.7%*	*0.54*	*1.08*	*2.62*	*0.39*

Cells shaded in GRAY indicate basins that were not directly monitored thus, peak flows and flow depths cannot be accurately stated.

The following results are noted:

- No basins or sub-basins exceeded 5% infiltration/inflow into their sewerage basin.
    - Most I/I flow within Basin 2 originates from Sub-basin 2b.
    - Most I/I flow within Basin 3 originates from Sub-basin 3a.
    - Most I/I flow within Basin 4 originates from Sub-basin 4d.
    - I/I flows within Basin 5 are relatively equal amongst the sub-basins.
- Basins 1, 2 and 3, and Sub-basins 2b and 3b exceeded a Peaking Factor of 3.0. It is noted that the monitoring sites for Basins 1 and 2 were located very close to the treatment facility, and peak flows may have been influenced by plant operation procedures and backflow conditions.
- At the flow monitoring sites for Basins 1 and 2, the d/D ratio exceeded 0.75. It is noted that these sites were located very close to the treatment facility, and the high depths of flow may have been influenced by plant operation procedures and backflow conditions.

Table 7 sums the total I/I for all three storm events and calculates the overall R-Value for each sub-basin. The basins are ranked according to the highest R-Value .

Table 7. Basin Prioritization based on R-Value

Basin No.	All Storm Events Total I/I (MGal)	Overall R-Value	Ranking Within Basin	Overall Ranking
1	**1.45**	**0.8%**	-	7
2	**3.16**	**1.0%**	-	-
2a	*0.15*	*0.1%*	2	11
2b	*3.01*	*1.5%*	1	2
3	**2.23**	**0.8%**	-	-
3a	*1.35*	*1.9%*	1	1
3b	*0.62*	*0.5%*	2	8
3c	*0.25*	*0.4%*	3	9
4	**0.92**	**0.6%**	-	-
4a+4b+4c	*0.14*	*0.3%*	2	10
4d	*0.95*	*1.3%*	1	4
5	**2.43**	**1.1%**	-	-
5a+5b+5c	*0.52*	*0.8%*	3	6
5d	*1.06*	*1.2%*	2	5
5e	*0.86*	*1.4%*	1	3
Total I/I for All Storm Events for Basins 1 thru 5:			**10.36 Million Gallons**	

Figure 10 below illustrates the distribution of totalized I/I by basin and sub-basin.

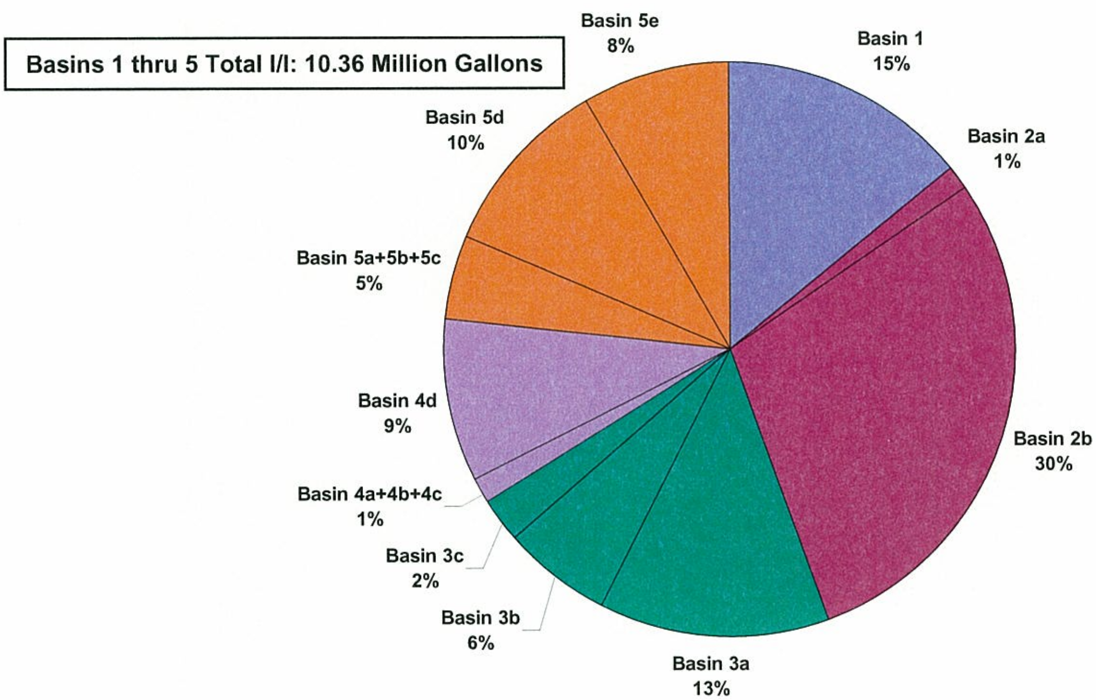

Figure 10. Pie Chart: Basin I/I Distribution

Ground Water Infiltration Analysis

Dry weather (baseline) flow can be expected to have a predictable diurnal flow pattern. While each site is unique, experience has shown that, given a reasonable volume of flow and typical loading conditions, the daily peaks and lows fall into a predictable range when compared to the daily average flow. If a site has a large percentage of ground water infiltration occurring during the periods of dry weather flow measurement, the peaks and lows will be dampened[7]. Figure 11 shows a sample of two flow monitoring sites, both with nearly the same average daily flow, but with considerably different peak and low flows. In this sample case, Site B1 may have a considerable volume of ground water infiltration.

Figure 11. Ground Water Infiltration Sample Figure

As the baseline flow calculations actually occurred during the month of February and after the wet weather season was underway, the timing of this analysis is particularly valid. Through experience, V&A has developed a ground water infiltration zone: if the peak-to-baseline and low-to-baseline flow ratios fall within this zone, and there are no other reasons to suspect abnormal flow patterns (such as proximity to pump station, treatment facilities, etc.), then there is a distinct possibility of high levels of ground water infiltration. Figure 12 plots the peak-to-baseline and low-to-baseline flow ratios against the baseline flows for all sites monitored during this study.

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7 Theoretically imagining an extreme case, if there were 0.2 MGD of baseline flow and 2.0 MGD of infiltration, the peaks and lows would be barely recognizable; the baseline flow would be nearly a straight line.

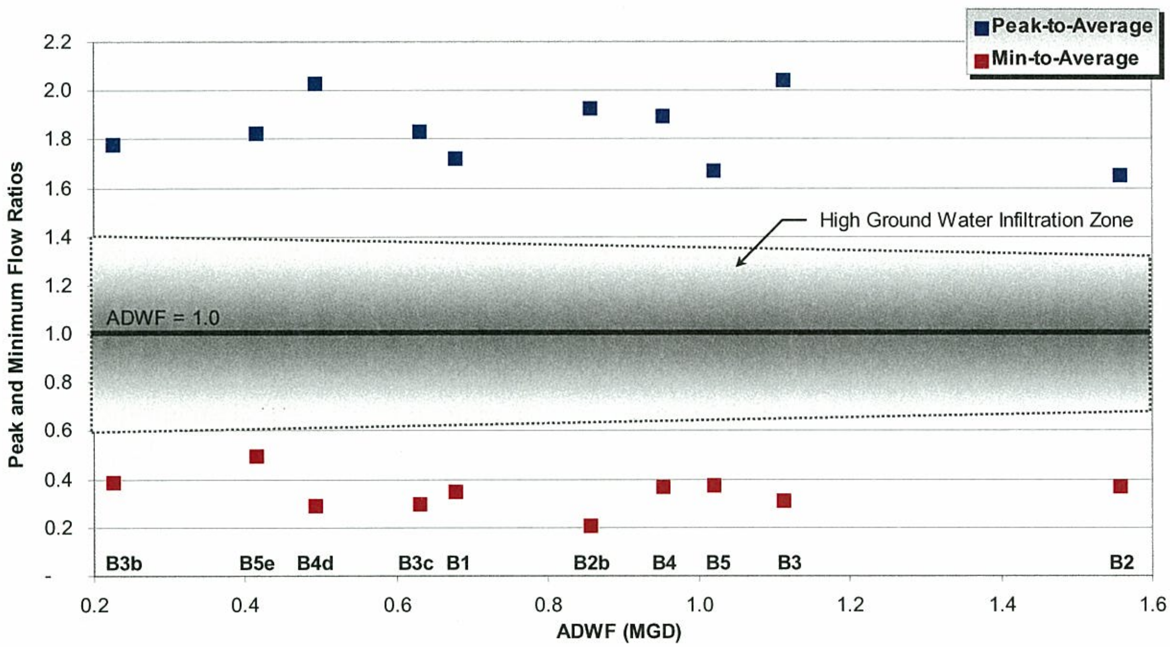

Figure 12. Pleasanton Peak and Minimum Flow Ratios vs. ADWF[8]

The City of Pleasanton collection system does not appear to have high levels of ground water infiltration.

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[8] Due to attenuation, it should be expected that sites with larger flow volumes should not have quite the peak-to-average and low-to-average flow ratios as sites with lesser flow volumes, which is why the infiltration zone slopes closer to 1.0 as the ADWF increases, as shown in the figure.

CONCLUSIONS

The City of Pleasanton collection system is generally performing well in terms of I/I. This conclusion is made based on the following results of this study:

1. **R-Values:** All monitored basins and sub-basins have R-Values less than 5%.
2. **Peaking Factors:** Basins 1, 2 and 3, and Sub-basins 2b and 3b had Peaking Factors greater than 3.0.
3. **d/D Ratios:** At the flow monitoring sites for Basins 1 and 2, the d/D ratio exceeded 0.75.
4. **Ground Water Infiltration:** There was no evidence of high levels of ground water infiltration into the collection system.
5. **I/I Impact:** Sub-basins 2b and 3a had the greatest I/I impact on the collection system.

RECOMMENDATIONS

V&A advises that future I/I reduction plans consider the following recommendations:

1. I/I reduction programs should commence with Basins 2b and 3a, and then be prioritized per the overall rankings shown in Table 7.
2. Basins 2b and 3a represent the sub-basins with the greatest need for action in terms of potential I/I reduction. These basins are recommended for future study which could include:
    a. smoke testing
    b. mini-basin flow monitoring
    c. night-time reconnaissance work to (1) investigate and determine direct point sources of inflow, and (2) determine the areas and/or pipe reaches responsible for high levels of infiltration contribution.
    d. CCTV inspection. Future CCTV inspection as used for condition assessment of the collection system should be prioritized to inspect the pipes within the Basins prioritized in Table 7.
3. Given the lower volumes of I/I flow into the collection system, the City should conduct a study to determine which is more cost-effective: (1) locating the sources of infiltration and inflow and systematically rehabilitating or replacing the faulty pipelines; or (2) continued treatment of the additional storm water I/I flow.

APPENDIX D - SOFTWARE EVALUATION MEMORANDUM

Pleasanton

WASTEWATER MASTER PLAN

TECHNICAL MEMORANDUM NO. 4

DRAFT
December 2003

carollo engineers

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City of Pleasanton

Wastewater Master Plan

Technical Memorandum No. 4
Hydraulic Model Evaluation

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1.0 INTRODUCTION

The City of Pleasanton (City) contracted with Carollo Engineers, P.C. (Carollo) to update their Wastewater Master Plan. A major component of the master planning effort is to develop a hydraulic computer model to analyze flow characteristics in the City's sanitary sewer collection system. The hydraulic model will provide Carollo and the City with a tool to identify existing collection system deficiencies and to recommend improvements needed to prevent excessive surcharging and overflows. The purpose of this memorandum is to evaluate hydraulic modeling software currently available and to recommend the hydraulic modeling software which is most appropriate for the City's needs and collection system.

Every model is a simplification of the real system. The applicability of a given model depends on how much simplification can be applied while still accurately representing the system. The most basic features of a model include a graphical user interface (GUI), input data, computational algorithms, and output data. Modeling software packages have a variety of strengths and weaknesses. Each software package is developed to fulfill the vision the software company has for the product, and the vision each software company has is influenced by the collective experience of the company and client base for that software. Therefore, a software package may be stronger for some applications than for others.

This document summarizes information about each vendor, explains software features, evaluates each software, and then provides a recommendation for a hydraulic model. The sections that follow are summarized below:

- *Software Vendors* – vendors that program, distribute and support the software products reviewed.
- *Evaluation Criteria* – criteria used to evaluate the applicability of each software product.
- *Screening Level Evaluation* – evaluation of models applicability to project.
- *Comprehensive Evaluation* – evaluation of short-listed models.
- *Recommendation* – model recommended for use on this project.
- *Product Summaries* – one page fact sheets, provided in the appendix, describing the features of each software product reviewed.

1.1 City's Collection System

The City's collection system is comprised of 10 major basins which convey wastewater to the Dublin San Ramon Sanitary District (DSRSD) Wastewater Pollution Control Plant (WPCP). The cities of Dublin, San Ramon, and Livermore also convey wastewater to the DSRSD WPCP. The City's collection system pipeline network ranges in size from 4-to 33-inches in diameter. All pipelines that are 10-inches and larger in diameter will be included in the hydraulic model, along with some 6-inch and 8-inch pipelines to maintain connectivity within the system.

There are ten lift stations in the collection system, however just the larger lift stations will be included in the hydraulic model. Some of the very small or temporary lift stations serving just a few parcels, need not be included in the hydraulic model.

2.0 SOFTWARE VENDORS

There are many software packages that can potentially address the needs of the City, and all vary in their methods of analysis and user friendliness. Seven (7) sanitary sewer modeling were evaluated and include:

H2OMAP Sewer by MWH Soft: MWH Soft is a subsidiary of Montgomery Watson Harza, Inc. MWH Soft is headquartered in Pasadena, California. The company has been providing the H2OMAP Sewer software package since 2001.

Hydra by Pizer, Inc: Pizer, Inc.is a software company with headquarters in Seattle, Washington. The company has been providing the Hydra software package since 1973.

SewerCAD by Haestad Methods: Haestad Methods, Inc. is a software company with headquarters in Waterbury, Connecticut. Haestad develops hydraulic modeling software for water, wastewater, and storm water systems. The company has been providing the SewerCAD software package since 1979.

MOUSE by Danish Hydraulic Institute: The Danish Hydraulic Institute (DHI) is a hydraulic research institution headquartered in Denmark. There are 3 offices in the United States: Pennsylvania, Florida and Portland, Oregon. MOUSE is their proprietary modeling sewer and stormwater software. The company has been providing the MOUSE software package since 1983.

Infoworks CS by Wallingford Software: Wallingford Software is a British software company. The US headquarters are in Fort Worth, Texas. The company has been providing the Infoworks CS software package since 1998.

XP-SWMM by XP Software, Inc. XP-Software, Inc is headquarted in Portland, Oregon. The company has been providing the XP-SWMM software package since 1993.

PC SWMM by Computational Hydraulics Institute: Computational Hydraulics Int. (CHI) is a consulting engineering firm specializing in stormwater management. CHI is headquarted in Ontario, Canada with a US office in New York. The company has been providing the PC-SWMM software package since 1984.

Carollo has developed summary sheets that contain a brief overview of these software packages, advantages and disadvantages of the software, license options, support and maintenance fees, available add-on modules, computer system requirements and cost. The summary sheets are presented in the Appendix.

A comparison of the technical features of the seven software packages is presented in Table 1. This table allows for a side-by-side comparison of similar features in each software package.

Table 1 Model Comparison
City of Pleasanton
Wastewater Master Plan

Technical Characteristics	H2OMap Sewer	Hydra[1]	SewerCad[2]	Infoworks	MOUSE	PCSWMM	XP-SWMM
Fully Dynamic, Quasi-dynamic or Static	Quasi-dynamic & Static Modes	Quasi-dynamic	Quasi-dynamic	Fully Dynamic	Fully Dynamic	Fully Dynamic	Fully Dynamic
Compatible with ArcView	yes	yes	yes	yes	yes	yes	yes
Reads shape files directly	yes	yes	no	no	yes	yes	yes
Writes to shape files directly	yes	yes	no	no	no	no	no
Converts shape file data using an interface	Direct, no conversion necessary	yes	yes	yes	yes	yes	yes
Tools to fix GIS data topology problems	yes	Partial	Partial	yes	Partial	Partial	no
Utilizies Standard Database Format	yes	yes	yes, proprietary	yes	ASCII-based	yes	ASCII-based
Automatically sizes new mains	yes	yes	yes	no	Add-on Module	no	no
Calculates pipe replacement costs	yes	yes	yes	no	no	no	no
Calculates loads based on land use	yes	via GIS	via GIS	yes	yes	yes	yes
Time step	User Defined	Restricted	User Defined	User Defined	User Defined	User Defined	User Defined
Scenario manager	yes	no	yes	yes	yes	yes	yes

Customizable tabular reports	yes	no	yes	yes	yes	no	yes
Graphically compares the results of multiple simulations	yes	no	yes	yes	yes	yes	no
Displays GIS data layers on screen	yes	no	no	yes	yes	yes	yes
Export tabular data to excel	yes	yes	yes	yes	yes	yes	yes
Single Licenses Cost (2000 pipe version[1])	$5,000	$4,500	$9,995	$32,000	$16,000	$600	$11,000
Maintenance and Service (Annual fee)	$1,000	$1,250	$3,498	$5,000	$2,000	free	$1,000
Software Training	$1,200	$1,200	$1,500	Free [3]	$500	$300	$1,000
Additional Modules	Load Allocator	None	None	None	GIS Interface	None	GIS Interface
Price of Additional Modules	$1,000	$0	$0	$0	$4,500	$0	$1,000
Water Modeling Software	Yes	No	Yes	Yes	No	No	No

Note:
(1) Hydra comes as a single unlimited pipe version.
(2) SewerCAD evaluation is based on the stand alone version. SewerCAD with AutoCAD is priced at $12,995 for 2000 pipe version with $4,548 annual support and maintenance fee.
(3) First training session is free with purchase of software.

3.0 EVALUATION CRITERIA

The City has requested that Carollo provide a recommendation on the software package to be purchased for the sanitary sewer collection system model. Carollo has evaluated several different software packages based on criteria established through experience and research. The criteria for the software evaluation will be as follows:

- Dry and Wet Weather Flow Calculations
- Hydraulic Calculations
- GIS Interface
- Scenario Management
- Customer Service and Support
- Cost
- Ease of Use

The evaluation criteria was established in order to evaluate the software based on qualities that will most directly benefit the City in the operation and maintenance of their sanitary sewer model. The City will need a model that is easy to operate even after long periods between uses, be compatible with GIS software and data sources, have the ability to analyze several scenarios with multiple facility options, and be cost effective. City staff will also find it necessary to use customer service and support to troubleshoot operating issues associated with model manipulation and analysis.

3.1 DRY AND WET WEATHER FLOW CALCULATIONS

Many of the models reviewed herein were first developed not only for sanitary sewers but also for stormwater sewers. Therefore, these models contain modules for hydrologic (or wet weather flow - WWF) calculations as well as hydraulic calculations. When used as sanitary sewer models, the wet weather flow calculations are used to calibrate the infiltration and inflow (I/I) process as the result of rainfall events, and then project these I&I responses to other rainfall events. Several of the models also have the ability to project dry weather flows (DWF) based on population, land use data, or parcel level water usage. Estimating accurate DWF and WWF is critical because all hydraulic calculations are based on these flows.

3.1.1 Dry Weather Flows

DWF's can be entered directly into a model, as a series of diurnal flows, or can be generated in the model based on population or land use estimates. Most of the models reviewed can accept a time series of diurnal flows. Certain models also have the ability to generate DWF's based on average dry weather flows (ADWF's) that are generated based on a population in a basin (in gallons per capita per day) or based on land use (in gallons per acre per day). Once the ADWF is estimated, a diurnal pattern can be applied to the ADWF.

3.1.2 Wet Weather Flows

WWF's can be generated using a variety of hydrologic techniques typically applied to stormwater runoff in order to approximate I/I in the collection system. Most models generate an I/I hydrograph by converting rainfall into flow based on the area that contributes flows to the collection system. Unlike stormwater, the area contributing to I/I in a sanitary sewer basin cannot be directly measured. Therefore, the area term is really a percent of the total sewer basin area, or "effective area," that contributes I/I (e.g. 5 percent).

Simple models usually employ a unit hydrograph type algorithm to generate the WWF hydrograph. This usually includes the use of an "effective area" variable that is sometimes referred to as an R-value. An R-value represents the amount of rainfall that enters a sewer basin as a percent of the total rainfall that fell on the basin (and is usually reported as a percentage). This variable, along with a variable that approximates the time of concentration of the basin is applied to the intensity of rainfall during a storm to calculate the I/I hydrograph. Some models include two or more of these types of hydrographs – one for inflow, and one or more for infiltration. If the system being modeled experiences little I/I, these simplistic routines may be all that is warranted.

Complex models employ a more rigorous estimation of WWF's. These models include more variables to better approximate the peak, volume, and shape of the I/I hydrograph by taking into account soil saturation and near surface groundwater interaction. These routines include linear reservoir, non-linear reservoir, and other combinations of algorithms. The more robust models like MOUSE, Infoworks CS, PCSWMM, and XP-SWMM employ these more complex routines to better approximate I/I hydrographs for systems that experience excessive WWF's.

3.2 HYDRAULIC CALCULATIONS

There are a variety of algorithms used to that perform hydraulic calculations. These algorithms are typically referred to as the hydraulic "engine" of the model. Within each category, the vendors often use slightly different methods of performing these calculations, or will accomodate boundary conditions in a different manner. Each algorithm has advantages and disadvantages with regard to performance, stability, and accuracy. The main three categories used in this comparison are as follows:

- **Steady state** calculations that assume normal depth for open channel pipeline flow. Extended period models make steady state calculations at specified time intervals throughout a simulation.
- **Quasi-dynamic** calculations route flow using a simplification of the Saint Venant equations while neglecting the momentum term in the equations. Kinematic wave approximations are an example of this category.
- **Fully dynamic** calculations solve the full Saint Venant equations and can calculate the full dynamic behavior of flow in a collection system.

A **steady state** model refers to hydraulic algorithms that apply uniform flow principles (steady in time) but vary over space (gradually varied over distance). Steady state models typically apply the standard step method to solve for the change in depth of flow over a length of pipe or open channel. The standard step method uses an iterative solution to approximate flow depth as flow changes between subcritical, normal, and supercritical along the length of a channel. However, the flow used in this method is constant and does not vary over the length of a channel (steady in time). When flows are added in this type of model, it is assumed that the peak flows are coincident as they progress downstream. This can lead to conservative estimations of peak flows at downstream locations when long lengths of channels or dendric networks are modeled. Steady state routines are used in SewerCAD and are an option in H2OMAP Sewer. The primary purpose of these types of models is for design applications.

The term quasi-dynamic is typically applied to models that utilize hydraulic algorithms that vary in both space and time (also referred to as unsteady in time and gradually varied in space). This type of model aggregates and attenuates flow hydrographs as they progress downstream and through a network of channels or pipes. The kinematic wave method is a common solution routine for this type of model.

The kinematic wave method applies an iterative approach to solve a portion of the Saint Venant equations. To simplify calculations, the momentum term is neglected, so the effects of inertia are not considered. Therefore, this method, like the steady state method, can only be applied in a downstream flow direction and cannot accurately approximate reverse flows, surcharge conditions, or complex structures (e.g. orifices, weirs, storage structures, etc). However, if a system does not experience surcharged flow conditions (i.e. maintains gravity conditions over the full range of modeled flows), then this solution should provide as accurate of flows, depths, and velocities as a fully-dynamic solution.

Quasi-dynamic models are more complex than steady state models and therefore are more computational intensive (which increase model run times), but are not as complex as fully dynamic models. Modeling software with quasi-dynamic algorithms include Hydra and H2OMAP Sewer, and are optional in SewerCad. XP SWMM and PC-SWMM also have a quasi-dynamic option. The primary application of these types of models is for planning level analysis, where the basic assumption is that when a pipe becomes full flowing, it requires an increase in size. Thus, the hydraulics of the system are sized so that they maintain gravity flow during the recommended design criteria or storm event.

A **fully-dynamic** model solves the full Saint Venant equations to account for both mass and momentum. The Saint Venant equations are partial differential equations and the full equations cannot be solved directly, but must be solved with an approximation technique. Two types of solution methods include explicit and implicit solution techniques. Implicit solution techniques are often referred to as more "stable" than explicit techniques. Without going into extensive detail on the solution of the Saint Venant equations, it suffice to say that higher complexity offers the modeler more flexibility in predicting complex hydraulics but can incur significantly more run time than quasi-dynamic models.

Fully dynamic models can accurately model gravity flow, transition from gravity to surcharge flow, full pressure flow, reverse flow, manhole overflows, looped connections, complex diversion structures, orificies, weirs and complex pump station operations. A fully dynamic model is necessary when these types of conditions exist in a sanitary sewer system. These types of models were first developed to accurately predict flows in combined sewer and stormwater sewer systems due to the hydraulic complexities usually encountered in these systems. However, if a sanitary sewer system encounters excessive I/I which causes surcharge, or has other complexities such as those stated above, a fully dynamic model is warranted.

Fully dynamic models are more complex, usually require more data, and can be more difficult to operate than quasi-dynamic models. Typically, modeling expertise is required to use them efficiently. MOUSE, Infoworks CS, XP-SWMM and PCSWMM are all fully dynamic models.

3.3 GIS INTERFACE

Municipal and utility operators use GIS software and databases to control, organize, and catalog system data into easy to access and useable formats. GIS compatibility is an essential element of any infrastructure modeling software. The ability to synchronize system databases with modeling software can result in significant time saving for City Staff. Packages should be able to display GIS data, such as land use maps, zoning, parcels and growth boundaries, on the screen in order to allocate flows, and evaluate new facilities based on planning assumptions.

Often times, GIS data has topology flaws that need to be corrected before the modeling software can run. Software packages with data diagnostic tools to identify and correct these topology flaws can save time in the model building and updating process.

3.4 SCENARIO MANAGEMENT

Typically, a planning level hydraulic model serves several purposes. First, the model is used to analyze the existing system and determine where capacity deficiencies and operational problems exist. The second is to look into the future and see how the system will respond when changes occur, such as land use changes. To be used effectively by City Staff, the model will need to be able to create and modify multiple scenarios in order to evaluate the effects of infrastructure changes and increased demands place on the collection system due to new developments. A models ability to create what-if scenarios is an important component of its operation, and when used for planning purposes, a scenario management tool is essential.

3.5 CUSTOMER SERVICE AND SUPPORRT

Operation of a computer model requires a direct relationship with the software vendor in order to troubleshoot any problems that may arise during model operation. Technical service representative, online help, help files and operating manuals all factor into the customer service and support evaluation. Customer support should be fast, responsive and technically qualified to handle the most advance modeling questions. New and infrequent users usually have many questions regarding the operation of modeling software, and a helpful and responsive customer support department can be an invaluable tool.

An evaluation of customer service and support provided by the software vendors is subjective at best, since the evaluation is influenced by the specific personalities of both parties, the relationship that may exist between the parties, and the time constraints that the vendor may be under during the time that contact is made. Anecdotal information obtained from other software users is subject to biases as well. However, establishing and maintaining a good working relationship with the vendor can be very helpful to maximize the benefits obtained from the software. Maintaining a good personal relationship with the software vendor is probably the most effective way to obtain extra support and software enhancements when needed.

3.6 COST

The cost of a software package involves several items. With any software package, the associated costs include a single license or network license fee, support and maintenance fees, additional add-on modules, and training. The cost range for the packages evaluated in this report range from $4,500 to $32,000. Software package costs are given in the information matrices (Table 1). The cost of the software should be appropriate for the intended use by the City.

3.7 EASE OF USE

In order for a model to be an effective tool for City Staff in planning and development, it must be user friendly and easy to operate after long periods without use. The operating system must be graphically based and intuitive in its operation. Adding facilities to the existing system and creating scenarios for new improvements should be straightforward and intuitive. This portion of the evaluation was intended to evaluate the software for its effectiveness in accommodating the needs of City Staff without the use of a full time modeling professional. City Staff will ultimately be the end user and it is assumed that the software will be used infrequently by the staff.

4.0 SCREENING LEVEL EVALUATION

Carollo conducted a preliminary evaluation based on the hydraulic calculations, cost, and ease of use criteria. Table 1 displays a comparison between the sanitary sewer modeling software's cost and technical characteristics. After looking at the criteria described above Infoworks CS, MOUSE, PCSWMM, and XP-SWMM were eliminated from the selection process.

Infoworks CS priced at $32,000 with an annual support and maintenance fee of $5,000 was not chosen due to excessive cost. The City may not need to update the system model every year and infrequent use does not justify the high annual expenditure.

XP-SWMM and PCSWMM were not selected since the software is less user-friendly when compared to other software packages and requires a good knowledge of hydraulic models to operate. These packages would not be the most logical choice for the City because the new or infrequent user will struggle with the operation, maintenance, and model updating.

MOUSE priced at $16,000 is the second most expensive software package that was evaluated. The MOUSE model has several nice features, however because the City's collection system does not have significant wet weather features, the expense of a fully dynamic model is not warranted.

5.0 COMPREHENSIVE EVALUATION

After the preliminary evaluation was completed, the remaining software packages, SewerCAD, H2OMap Sewer and Hydra were further evaluated.

5.1 Dry & Wet Weather Flow Calculations

All three software packages have varying capabilities of modeling dry and wet weather flows. The City's model will be utilizing both parcel level water usage and the general plan land use to develop the existing and future dry weather flows. H2OMap Sewer has the most options for developing dry weather flows from a variety of sources. It performs these calculations in the actual modeling software, rather than the GIS like Hydra. Hydra has the capability of developing DWF's from a land use, sewer basin level or parcel level basis. However, most of the DWF calculations are performed in the GIS and imported into the model at the basin or parcel level. SewerCad also has the ability to import the DWF calculations from the GIS. SewerCad can allocate population or land use at the manhole or sewer basin level. All of the software packages also have the capability of loading user-defined hydrographs into the model.

Based on conversations with City Staff and analysis of historical flows in their collection system, it does not appear that the sewer system has significant wet weather flow issues, ie that the system does not operate in a surcharged mode during most rainfall events. Applying the more simplistic routines of I&I generation that the quasi-dynamic models offer is thus adequate for master plan level modeling needs. Hydra, H2OMap Sewer and SewerCad offer the unit hydrograph method for developing WWF's. In addition, H2OMap Sewer and SewerCad offer other methods of generating static-type wet weather flow loading like gallons per acre per day (gpad). All three software packages have the capability of loading user-defined wet weather hydrographs into the model.

Another consideration for the City in selecting a software package may be to use the same hydraulic model that the other communities contributing to the DSRSD WPCP are using. This will benefit each agency by using similar methods to quantify and route DWF's and WWF's in their respective systems to the WPCP. When flow comparisons are made between the agencies, the fundamental methods of calculating and routing flows will be similar.

5.2 Hydraulic Calculations

The City's collection system is relatively simple in comparison with the collection systems of large cities, particularly where the elevation is flat and the annual precipitation is high. The model will be used for master planning studies to size future mains and will not be analyzing flow conditions that require fully dynamic model functionality. The purpose of the future planning scenarios is to analyze the model for sizing mains in a way that surcharging in manholes does not take place. Therefore, the fully dynamic modeling functionality would most likely not provide more value than a quasi-dynamic model in sizing mains or in understanding the hydraulic behavior in the network.

The quasi-dynamic model is appropriate for the City because it will route flows through the collection system to simulate the time varying effects of the wastewater hydrograph to ensure that the maximum allowable depth in the mains is not exceeded at an accuracy and level of detail that will provide good results.

Hydra, H2OMap Sewer, and SewerCAD all have quasi-dynamic hydraulic engines that will provide a reasonable approximation of hydraulic behavior in the network.

5.3 GIS Interface

All three software packages have GIS capabilities with SewerCAD being the most limited. Intermediate steps are required to import and export from SewerCAD, and non-infrastructure GIS data layers cannot be displayed on screen. Also, SewerCAD has a limited ability to fix topology problems within the model.

Hydra requires a transfer wizard to import and export GIS files, but it can be problematic. One nice feature of Hydra is that any data in the model can be exported into GIS, including model output. Hydra will perform a connectivity (or topology) check, but does not always identify where the problem is, or have tools to fix the connectivity problems. Connectivity must be corrected in GIS or AutoCAD and imported back into the model.

H2OMap Sewer is the only package that stores data and model results directly into GIS shape files. Mapping routines are still needed to translate GIS data, but once converted the files can be read with ArcView Software. Loads can be allocated using multiple polygon extraction methods that interface with GIS layers and then bulk loaded into the model, which saves considerable time in the flow allocation process. Additionally, model output is stored in shapefiles that can be used in the presentation of model results.

5.4 Scenario Management

Hydra offers no scenario manager and any changes to the model, such as the addition of new facilities or improvements must be made in AutoCAD or GIS and imported back into the model.

H2OMap Sewer and SewerCAD offer sophisticated parent child tree scenario creation and management schemes. This feature allows the user to set up multiple what if scenarios based on a variety of model parameters. H2OMap Sewer also has a facility manager, which enables the model to display only the facilities that are modeled in that simulation. The H2OMap Sewer data set manager is very useful in organizing and controlling what facilities and controls are associated with each scenario. In SewerCAD, all facilities are displayed for all scenarios. Therefore, facilities that are not present in a particular scenario must be turned off manually.

5.5 Customer Service and Support

MWHSoft customer support has been good with timely and supportive response to issues, such as software bugs and technical problems. MWHSoft has shown that they are responsive to clients needs and are able to quickly provide enhancements when needed. Instructional manuals are not very comprehensive, so e-mail and telephone support is used to a greater extent.

SewerCAD offers several support and maintenance options. Users have the option to pay an annual fee or pay a price for each service contact. Anecdotal information obtained from other users was less complimentary on timely responses.

The Hydra support is responsive and can successfully handle support problems. Turn around time can be between one to three days, and support staff members have access to hydraulic engine and interface experts.

5.6 Cost

Software costs are a major factor in the selection of a modeling package. Costs discussed here are for a 2,000-pipe version unless otherwise noted.

H2OMap Sewer has a single license fee of $5,000,and a load allocation module that runs an additional $1,000. Support and maintenance fees cost $1,000 annually.

At $9,995 dollars for a stand-alone version, SewerCAD is the more expensive than Hydra or H2OMap Sewer. With an additional $3,498 for maintenance and support, the software is almost twice as expensive as software packages with similar or greater capabilities.

Hydra at $4,500 is the least expensive, and the package comes as an unlimited pipe version. Maintenance and support fees run $1,250 per year.

5.7 Ease of Use

The ease of use of each package is an important factor in the software selection. Hydra is the least user friendly of the three. It is difficult for a new user to learn and apply, and managing the many ASCII files that are required to perform a simulation can be difficult until the operator has spent considerable time working with the model.

The H2OMap Sewer interface has many features that help the user to quickly see and identify associated facility data and controls. The attribute browser allows you to click on a facility and view or edit the attached database. Another nice feature is that output results are viewed in the same window as the model input. This feature is useful for analysis when focusing on specific sections of the system, such as new facilities or system upgrades. The user interface has a Control Center that displays GIS layer information as well as operational data, annotation, and map display operations that create an easy means to manipulate operational data and view output results for the entire system.

SewerCAD was the most intuitive and navigable of all the packages for the new or infrequent user, and has a click and edit feature for facility manipulation. Unit conversion are very easy with the “Flex Units” library. One drawback of the SewerCAD software is that it uses a proprietary database. In doing so, external databases cannot be used to view or edit model data or output results.

5.8 Compatibility with Other Modeling Software

Haestad and MWH Soft both provide excellent water modeling software packages. The City is currently using MWH Soft's H20Map Water model. The user interface for the water modeling software is very similar to the sewer modeling software. This could be very beneficial to the City to have a common interface between their water and sewer modeling packages, especially for the infrequent user.

6.0 RECOMMENDATION

The City could successfully implement a sanitary sewer-modeling program using either Hydra or SewerCAD. MWHSoft's H2OMap Sewer software is recommended as the preferred option for the City because it not only meets the requirements, it provides the best GIS capabilities of all the software packages. The user interface is intuitive and as easy (or easier) to learn than other software. Also, H2OMap Sewer offers an excellent scenario manager and is cost competitive.

7.0 IMPLEMENTATION

The key to successfully implementing a hydraulic modeling program within a utility is the commitment to the time and expertise necessary to have staff who are proficient in the modeling software and who keep the model current so that it can be used regularly to help make good planning, design, and operational decisions. City staff will need to be able to fill the following roles relative to a modeling program:

- **Model Owner** – Makes sure that the software, hardware, and human resources necessary to have a modeling program are in place.
- **Modeler** – The actual user of the software who has a personal interest in modeling, and has invested the time to become proficient in its use.
- **Model Maintainer** – The person responsible for ensuring that the model is current, and has a good understanding of modeling requirements, GIS data, and related software tools.

The hydraulic models are regularly updated to provide new functionality or to keep up with current technology. Thus paying maintenance and support fees, as well as keeping the software upgraded is recommended.

All vendors provide training, and this training is recommended in addition to the training provided within this contract, as well as for new modeling staff that may become involved with modeling in the future. Training by the vendor provides a different perspective on the modeling software, and would help the City to establish a relationship with the vendor.

APPENDIX A - SOFTWARE FACT SHEETS

H_2OMap Sewer, MWH Soft

Overview

MWH Soft, based in Pasadena, California, is a subsidiary of MWH Global. The hydraulic engine uses a quasi-dynamic model in which the momentum term in the St. Venant equation is neglected. Neglecting the momentum term often results in a more conservative solution. H2OMap Sewer has a seamless connection to ESRI's ArcView and can integrate land use or other GIS data directly into model calculations. A load allocator module can be purchased for an additional fee, which calculates water duty coefficients, and bulk loads flow allocations.

Advantages

H2OMap Sewer has a full featured and user-friendly scenario and domain manager that's useful for data queries and output management. Load allocator has five load allocation methods to choose from, and eliminates GIS and Excel data transfers to calculate loads. The software has routines to fix topology and other data problems. Hydrology calculations make it possible to route overland flows to the collection system. The software architecture makes data transfer to and from the software simple. Although manuals are lacking in content, the technical support services are timely and helpful. License fees are less expensive when compared to other software packages of equal quality.

Disadvantages

The model is quasi-dynamic so it cannot model complex hydraulics such as weirs, orifices, in-line storage, real-time control, flow reversal. Instruction manuals are not comprehensive and technical support via the telephone is relied on much more than documentation.

Single License Fee

$4,000

Support and Maintenance

$1,000

Additional Modules

Load Allocator, Cost = $1,000

System Requirements

Minimum Requirements - Pentium 450 MHz (or higher) with 128 MB of RAM (256 MB recommended).

Hydra, Pizer

Overview

Pizer, Inc. in Seattle, Washington developed HYDRA. HYDRA is a quasi-dynamic model; using the Kinematic Wave equation to route flows through the system. The Kinematic Wave equation is a simplification of the fully dynamic St. Venant equations. Manning's equation is used to calculate pipeline capacity and backwater elevations are calculated by proprietary methods. The user must define flow splits at diversion manholes, proportioning the flow splits based on hydraulic grade line elevations determined for each of the downstream pipelines. The program interfaces with GIS through ESRI's ArcView, using a stand-alone import/export program. The program also interfaces with AutoCAD for adding elements such as pipelines, manholes and basins. There is no charge for incremental upgrades, patches, or bug fixes. HYDRA training and support is available from Pizer, Inc., and a working knowledge of ArcView and AutoCAD is advantageous.

Advantages

Good planning level model if hydraulics within the system are not complex. Results provide pipeline-sizing recommendation, both parallel and larger diameter. Can export readily to the GIS using a stand-alone interface. The GIS export allows any data within the model database to be exported, including all parameters associated with a specific run. Will perform a topology check, but does not always identify where the problem is, or have tools to fix the connectivity problems. Connectivity must be corrected in GIS or AutoCAD. Maintains separate hydrographs for each flow component (base flow, inflow, groundwater infiltration, trench infiltration) throughout the system. Each of the flow component hydrographs can be exported to spreadsheet.

Disadvantages

Cannot model complex hydraulics such as weirs, in-line storage, real-time control, flow reversal (or backwater resulting in negative flow), etc. User-defined flow splits must by input, rather than having flow splits determined within the model using the hydraulic grade line. Pumping capacity at a lift station is limited to a one-point curve. The user cannot add or delete system components within the model interface. This function is performed in AutoCAD or the GIS, and imported back into the model. Can load the results for any layer that is available, thus the collection system layer that is being viewed may not be the one corresponding to the results database. Model has a restricted time-step during analysis (i.e 15-minute for 2 days or 30-minute for 5 days).

Single License Fee

$4,500

Support and Maintenance

$1,250

Additional Modules

None

System Requirements

Minimum Requirements - Windows 95/98/NT and 32 MB RAM

SewerCAD, Haestad Methods

Overview

tad Methods in Waterbury, CT developed SewerCAD. The current version of SewerCAD is si-dynamic model. While this model is not fully dynamic, the developer states it allows the o apply a time-series element to the flow. SewerCAD uses the hydrologic routing and a s of gradually varied flow backwater profiles to route the flow through the system. Until a lynamic model is developed, this software package is considered a steady state model with quasi-dynamic capabilities. SewerCAD can be purchased as a single copy or a network is available for an additional cost. Maintenance is free for the first year and is available in levels of "Client Care" thereafter. Updates and future upgrades are free for all Client Care and various levels of engineering and technical support are available at each level. nical support is available seven days a week and includes an engineer on call to answer ions.

Advantages

The software has an easy to use and intuitive graphical user interface. SewerCad has a parent child relationship scenario manager that make creating and manipulation of scenarios easy. Unit conversions are very easy with "Flex Units". SewerCad also has a nice pipe design and cost estimating feature.

Disadvantages

SewerCad is a static model with a option to model in quasi-dynamic mode. The software does not have a direct access to a GIS interface. Intermediate steps are required to import and export GIS data. Individual facilities must be turned off in each scenario and remain visible on the screen when switching back and forth from one scenario to another. Non-infrastructure type GIS data, such as land use or parcels, cannot be displayed on screen. SewerCad also lacks the ability to plot more than one element at a time making system comparisons difficult. The cost for the software is expensive considering it's not a fully dynamic model.

Single License Fee

$9,995

Support and Maintenance

$3,498

Additional Modules

No additional modules required

System Requirements

Minimum Requirements - Pentium III at 450 MHz (Pentium 4 at 1.2 GHz recommended) 128 MB RAM (256 MB Recommended), windows 2000 or XP, AutoCAD version 2000 or later

MOUSE, Danish Hydraulic Institute
Overview
MOUSE was developed by DHI and is a fully dynamic model. It solves the full St. Venant equation with the implicit finite difference solution. The Model can interface with ArcView, but this requires the MOUSE GIS module be purchased as an add-on module. MOUSE can be purchased as a single or network copy with one “seat.” One “seat” allows the program to be used at different locations, but only one user per license is allowed to operate the program at a given time. There is free maintenance for the first year. A maintenance fee is required for subsequent years and upgrades are included in the maintenance cost. Lifetime technical support is available for users through Boss, International. In June 2004, DHI will integrate MOUSE with Mike Net under one GIS interface which DHI will call Mike Urban. A customer with an existing maintenance agreement will receive a free upgrade to Mike Urban.
Advantages
MOUSE is one of the most user-friendly fully dynamic models available on the market. MOUSE has a comprehensive Rain Derived Inflow and Infiltration (RDII) module where I/I is separated into rapid (inflow) and slow (infiltration) response components. MOUSE has a good Real Time Control (RTC) module, and a pipe designer feature which allows the user to set specific design criteria.
Disadvantages
Cost have now become a factor and Mike Urban will increase the cost an additional 20-40%. The GIS interface add-on module is expensive, considering this feature is standard in most hydraulic models.
Single License Fee
$16K. $19K - $23K for Mike Urban starting June 2004
Support and Maintenance
$2,000
Additional Modules
GIS Interface, Cost = $4,500
System Requirements
Minimum Requirements - Windows 95/98/NT/2000/XP or later, 90 MHz processor (400

MHz recommended), 16 MB RAM (64 recommended), 100 MB of hard disk space for installation. These requirements are likely to increase with the addition of Mike Urban

Infoworks CS, Wallingford Software

Overview

Wallingford Software, Ltd. located in the United Kingdom developed InfoWorks CS. Applied Geographic Technologies, Inc. (AGT) is the United States representative (Fort Worth, TX) for sales and support. InfoWorks CS is an updated version of the company's HydroWorks product with more advanced graphics and database capabilities. InfoWorks CS is a fully dynamic model and uses a fully implicit scheme to solve the St. Venant equations. It incorporates GIS data directly into its framework and can tie flow and load calculations back to the population and land use model directly. InfoWorks CS runs entirely off of database formats, rather than ASCII code input files. The software package has significantly advanced query and graphic presentation capabilities over the MOUSE and SWMM models. InfoWorks CS can be purchased as a one "seat" copy that contains a real-time control module, and one training session to be provided by AGT in Fort Worth, TX. Annual support and technical support are provided at an additional cost after the first year. The annual and technical support includes all upgrades.

Advantages

InfoWorks CS is a fully dynamic model with a useful and user-friendly GIS interface. The scenario manager is excellent and data can be color coded to reflect the source. Overall, the interface is very user friendly. The model supports multiple database formats with exporting data very simple. Real time HGL's and real time control module add to the overall package.

Disadvantages

The main disadvantage of this package is cost. Also, the software also does not have a pipeline planning feature for sizing future networks or improvements.

Single License Fee

$32,000

Support and Maintenance

$5,000

Additional Modules

None

System Requirements

Minimum Requirements - Pentium II 266MHz PC with 128Mb RAM, and a 1024x768 high-resolution screen, Windows 95/98/Me, Windows NT 4.0 or Windows 2000/XP operating system (NT4.0/2000/XP Preferred). The software is distributed on CD-ROM, and is a full 32-bit application, supporting long file names, and IT configurations involving Local Area Networks (LAN's).

XP-SWMM, XP Software

Overview

XP Software in Portland, OR developed XP-SWMM. The model uses a SWMM-based hydraulic engine, however XP-SWMM enhances the SWMM computational methodology with use of a proprietary module called the “Dynamic Wave” which allows for the explicit incorporation of real time control devices, using a variable time step to generate a more stable solution and decrease run times. The software can be purchased as a single copy or a network copy is available for an additional fee. Free software maintenance is available for the first year and for an annual fee thereafter. The maintenance agreement includes any upgrades that are released throughout the calendar year. All XP products have free lifetime product support and technical support is available for a fee. The model can be operated with a variety of GIS platforms, but has a separate GIS module available for a direct link to the database embedded within the GIS. The program and module support the display of CAD backgrounds, image files, GIS files, and digital satellite photos. The model can use metered information imported from external files.

Advantages

Cost competitive for a fully dynamic hydraulic model. Technical support is readily available and will accommodate requests for improving their software and interface. Has a nice variety of viewable results, including animated HGL profile plots. There are several options for defining dry weather flows, infiltration parameters, and rainfall analysis. Can display several image files, AutoCAD files or shape files as background images. Can store information in a global database, rather than attached to a specific pipeline. Can customize tabular results for export to a spreadsheet.

Disadvantages

No GIS export capabilities, so changes in the model must be changed in the GIS manually. As with any of the SWMM models, they are complex to learn and typically require expertise in modeling to use efficiently. Does not have good planning level tools (i.e. a pipe designer module). No data verification or topology tools to aid in reconciling digitization problems or incomplete data sets. Querying tools are limited to data input or result fields. Has added database like view but still relays on “forms” for many data inputs. Longterm simulation is difficult if modeling more than one week of hourly data.

Single License Fee

$11,000

Support and Maintenance

$1,000

Additional Modules

GIS Interface, Cost = $1,000

System Requirements

Minimum Requirements - Windows 95/98/NT4/2000/XP or later

PCSWMM , Computational Hydraulics Institute

Overview

PCSWMM is a graphical user interface (GUI) to EPA SWMM program. It was developed by Computational Hydraulics Institute (CHI) of Guelph, Ontario. The major modules of the GUI include a GIS interface, excellent time series graphing and editing capabilities, an object oriented system to link the various SWMM blocks (e.g. Rain to Runoff to Extran), tabular database editing, and a rainfall analysis module. The newest version of PCSWMM will also support the new EPA SWMM5 engines in effect taking the place of the free SWMM GUI. PCSWMM is a fully dynamic model that is primarily used for stormwater and sewer modeling of complex hydraulics.

Advantages

PCSWMM is the most inexpensive dynamic model on the market. The time series modules work very well for long time series of data (e.g. beyond a weeks worth of hourly data). The time series can also plot measured vs. modeled flows, as well as superimpose the rainfall hyetographs on an accompanying graph. The graphing feature alone is worth the cost of the program. The GIS module has also been updated to take full advantage of new GIS features. This is a very good model for clients that are just getting into modeling, don't want to spend a lot of money, and may want to take the model over when the project is complete. The developers will readily work with clients to make changes and add new features.

Disadvantages

CHI is not a large company and thus does not have the extensive backing that other models provide. Technical support is free, but can take some time to get questions answered. As with any of the SWMM models, they are complex to learn and typically require expertise in modeling to use efficiently.

Single License Fee

$600

Support and Maintenance

Free by email

Additional Modules

None

System Requirements

Windows 95/98/NT/2000/XP.

APPENDIX E - ADDITIONAL SURVEYING

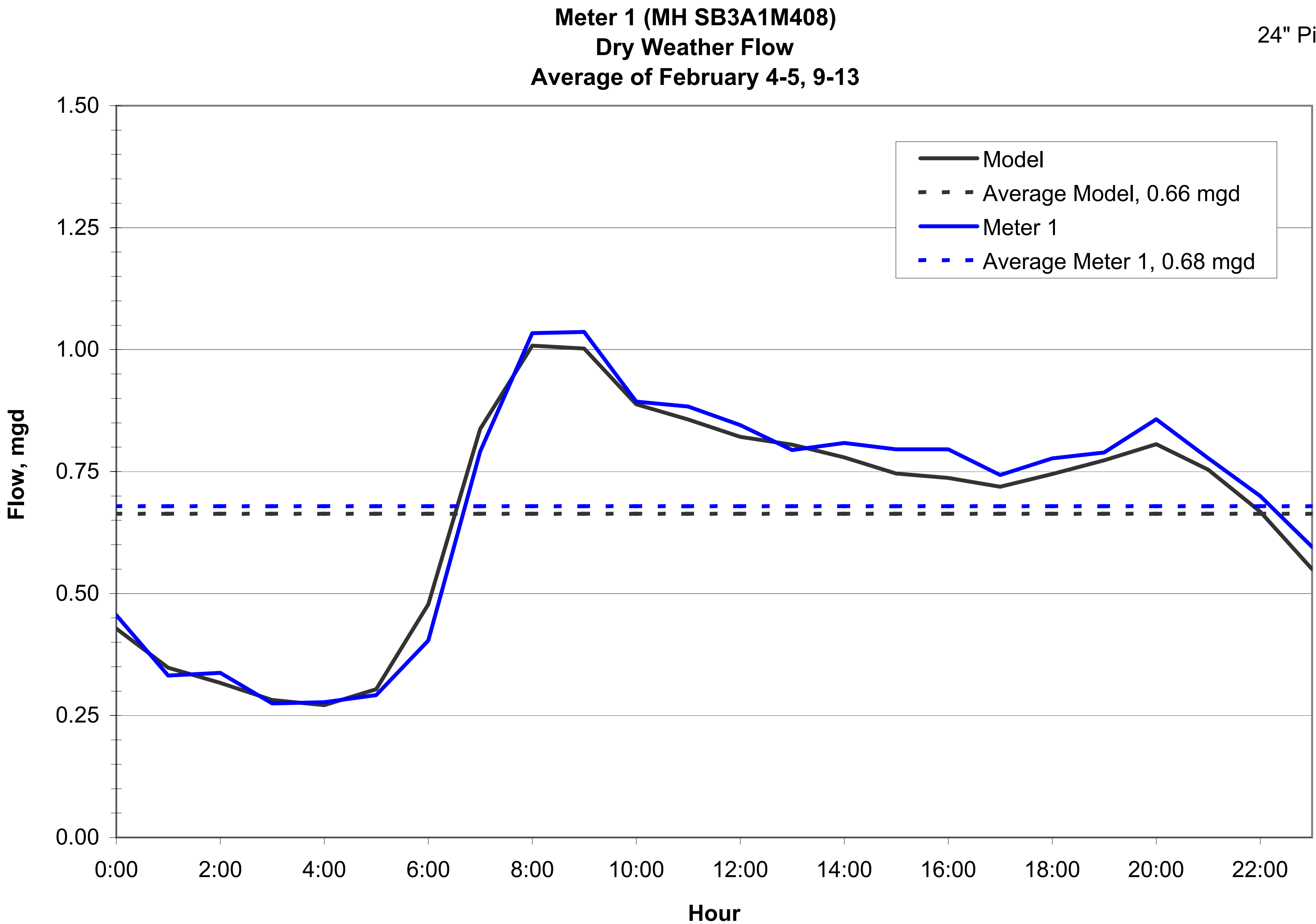
PT. NO.	MANHOLE ID	SITE NUMBER	TYP FACILITY	NORTHING CCS83	EASTING CCS83	ELEV NAVD88	STRUCT. ROD	STRUCT. INVERT	-ROD 1	INVERT	SIZE, TYPE	-ROD 2	INVERT	SIZE, TYPE	-ROD 3	INVERT	SIZE, TYPE	-ROD 4	INVERT	SIZE, TYPE	-ROD 5	INVERT	SIZE, TYPE
103	B3A1M409	4	SSMH	2075793.16	6152151.68	330.38	18.4	312.0	18.4	312.0	24"RCP	18.2	312.2	24"RCP									
104	B3A1M411	3	SSMH	2075775.45	6152111.06	330.38	CAN'T SEE		CAN'T SEE														
105	B3A1M406	2	SSMH	2075740.76	6152044.82	330.30	18.3	312.0	18.3	312.0	24"SS	18.2	312.1	24"SS									
106	B2C3K406	9	SSMH	2076742.78	6152397.34	330.10	27.1	303.0	FULL OF WATER														
107	B2C4M400	10	SSMH	2076784.88	6152905.58	328.26	25.9	302.4	FULL OF WATER														
108	B3A2M300	6	SSMH	2075847.25	6153043.35	325.94	6.1	319.8	6.1	319.8	6"SS	5.8	320.1	4"VCP	5.9	320.0	4"VCP						
109	B3A2M300	6	SSMH	2075838.80	6153046.52	325.60	21.5	304.1	21.5	304.1	33"RCP	21.4	304.2	33"RCP									
110	B3B1M204	11	SSMH	2076066.18	6155541.03	329.28	23.1	306.2	23.1	306.2	33"RCP	22.8	306.5	15"STEEL	22.8	306.5	30"RCP						
111	B2D3M102	12	SSMH	2077263.57	6155403.71	330.19	21.8	308.4	FULL OF WATER														
112	B2D3M104	13	SSMH	2077220.96	6155574.87	329.55	19.3	310.2															
113	C2C3M201	14	SSMH	2077207.23	6158104.60	329.54	16.2	313.3	16.2	313.3	18"VCP	16.2	313.3	18"VCP	16.0	313.5	8"VCP						
115	C2C4M206	16	SSMH	2077099.09	6159928.51	332.06	20.6	311.5	20.6	311.5	24"VCP	18.9	313.2	10"VCP	20.5	311.6	24"VCP	19.1	313.0	15"VCP			
116	C2D3M300	17	SSMH	2076969.89	6161593.32	342.98	28.5	314.5	28.5	314.5	24"VCP	27.5	315.5	15"VCP	28.4	314.6	24"VCP						
117	C3B2M206	20	SSMH	2076211.10	6163023.53	345.64	21.2±	324.4±	21.2±	324.4±	UNKNOWN	21±	324.6±	UNKNOWN	20.9	324.7	8"VCP						
118	C3B2M105	19	SSMH	2076367.39	6162908.89	345.75	22.7	323.0	22.7	323.0	18"VCP	22.6	323.1	15"VCP	22.3	323.4	18"VCP						
119	C3B2M309	21	SSMH	2075863.77	6163101.42	342.79	18.8	324.0	18.8	324.0	27"VCP	17.7	325.1	10"SS	18.8	324.0	24"VCP						
120	B3A1M411	3	SSMH	2075740.26	6152074.18	330.04	18.9	311.1	CAN'T SEE			6.6	323.4	18"SS									
121	B3A1M411	3	SSMH	2075740.19	6152079.01	329.97	19.0	311.0	CAN'T SEE			19.0	311.0	18"SS									
122	B3A1M411	3	SSMH	2075768.27	6152155.53	330.10	20.3	309.8	CAN'T SEE		36"SS	CAN'T SEE		36"SS	CAN'T SEE		12"SS						
123	B3A1S302	5	SSMH	2075833.08	6152433.63	331.35	20.2	311.1	20.2	311.1	48"RCP	20.1	311.2	48"RCP									
124	B3A1S302	5	SSMH	2075798.78	6152418.52	330.43	ABAND.																
127	C2C4M205	15	SSMH	2077069.86	6159841.74	333.24	CAN'T SEE		CAN'T SEE		24"SS	CAN'T SEE		24"SS									
128	C3B1M413	18	SSMH	2075785.18	6161847.21	336.71	18.1	318.6	18.1	318.6	6"VCP	17.6	319.1	6"PLUG	ABAND.			17.2	319.5	6"VCP			
131	C3B4M203	22	SSMH	2075112.44	6163166.51	343.38	9.5	333.9	9.5	333.9	10"SS	9.3	334.1	10"SS	9.5	333.9	10"SS						
132	B3C4M401	23	SSMH	2072599.57	6153637.29	323.70	27.1	296.6	27.1	296.6	36"SS	26.9	296.8	36"SS									
133	B3D3M101	24	SSMH	2073234.15	6155315.30	324.28	26.2	298.1	26.2	298.1	36"SS	26.0	298.3	27"SS									
134	B3A1M404	1	SSMH	2075702.31	6151895.91	326.36	14.1	312.3	13.7	312.7	24"SS	14.1	312.3	14"SS	13.7	312.7	10"SS	13.7	312.7	8"SS	5.1	321.3	6"PVC
138	B3A1M504	7	SSMH	2075445.69	6151977.56	324.79	11.3	313.5	11.3	313.5	18"SS	5.8	319.0	10"PVC	10.7	314.1	18"SS						
139	B3A3M301	8	SSMH	2074914.21	6152118.55	323.90	7.3	316.6	7.3	316.6	18"SS	5.0	318.9	12"PVC	7.1	316.8	18"SS						
142	B4A2M400	25	SSMH	2071612.32	6153093.75	319.03	22.8	296.2	22.8	296.2	24"RCP	21.5	297.5	8"SS	22.4	296.6	24"RCP						
143	B4C2M202	26	SSMH	2070197.55	6153564.02	320.59	19.6	301.0	19.6	301.0	24"SS	18.2	302.4	10"SS	19.4	301.2	24"SS						
144	B4C4M300	27	SSMH	2068718.97	6154001.04	319.41	16.9	302.5	16.9	302.5	18"SS	16.9	302.5	18"SS									
145	B5B3M300	30	SSMH	2066872.67	6154713.73	320.27	15.2	305.1	15.2	305.1	18"SS	13.9	306.4	8"PVC	15.2	305.1	18"SS						
146	B5B3M200	29	SSMH	2067191.74	6154545.59	319.53	14.8	304.7	14.8	304.7	18"SS	14.0	305.5	8"SS	13.5	306.0	6"PVC	14.7	304.8	18"SS	13.9	305.6	8"SS
152	B5D1M201	31	SSMH	2066057.55	6155029.92	324.23	15.2	309.0	15.2	309.0	24"RCP	14.5	309.7	12"RCP	15.1	309.1	24"RCP						
153	B5D1M302	32	SSMH	2065971.92	6155078.37	324.03	17.1	306.9	17.1	306.9	21RCP	17.0	307.0	21"RCP									
154	B5D4M302	34	SSMH	2064836.94	6156149.23	324.24	14.0	310.2	14.0	310.2	27"RCP	13.9	310.3	27"RCP									
155	B5D4M301	33	SSMH	2064825.35	6156122.52	323.89	15.3	308.6	15.0	308.9	18"RCP	15.2	308.7	18"RCP									
156	C4C2M203	35	SSMH	2070021.34	6159246.02	331.97	18.9	313.1	18.9	313.1	18"RCP	16.8	315.2	10"RCP	18.8	313.2	16"RCP	18.3	313.7	8"RCP			
157	C4C2M201	36	SSMH	2070052.84	6159244.82	332.42	14.1	318.3	14.1	318.3	24"RCP	13.1	319.4	12"RCP	13.8	318.6	22"RCP	14.0	318.4	10"RCP			
158	C4C2M204P	37	SSMH	2070119.26	6159300.22	332.21	19.0	313.2	19.0	313.2	18"RCP	18.9	313.3	12"RCP	7.7	324.5	8"RCP	18.8	313.4	8"RCP			
159	C4D3M403	38	SSMH	2068672.43	6161125.17	345.90	20.3	325.6	20.3	325.6	22"RCP	20.2	325.7	22"RCP									
160	D5A3M100	40	SSMH	2067392.50	6163954.43	354.49	ABAND.		NO OUT			7.8	346.7	10"VCP									
161	D5A1M105	39	SSMH	2068225.89	6164316.12	349.60	13.3	336.3	13.3	336.3	12"RCP	12.1	337.5	8"RCP	13.3	336.3	8"RCP						
162	D5A4M402	43	SSMH	2066771.25	6165099.93	375.86	10.0 DRY	365.9	10.0	365.9	12"RCP	10.0	365.9	12"RCP	10.0	365.9	10"RCP	10.0	365.9	10"RCP			
163	D5A4M301	42	SSMH	2066827.69	6165168.11	374.34	8.1	366.2	8.1	366.2	8"RCP	7.9	366.4	6"RCP									
164	D5A3M505	44	SSMH	2066409.64	6164792.37	372.02	11.2	360.8	11.2	360.8	10"PVC	10.9	361.1	8"RCP	11.0	361.0	8"PVC	11.0	361.0	6"RCP			
165	D5A4M109	41	SSMH	2067308.84	6166051.64	358.96	8.1	350.9	8.1	350.9	15"VCP	8.0	351.0	15"VCP	6.3	352.7	6"VCP						
166	C6B2M405	45	SSMH	2063680.83	6162161.68	330.07	16.9	313.2	16.9	313.2	24"VCP	16.6	313.5	12"VCP									
167	C5D3M400	46	SSMH	2064753.30	6160986.02	331.03	14.6	316.4	14.6	316.4	15"RCP	14.3	316.7	15"RCP									
168	C5D3M200	47	SSMH	2065155.49	6160488.08	330.05	15.7	314.4	15.7	314.4	24"SS	12.5	317.6	12"VCP	15.6	314.5	18"VCP						
172	B5A4M206	28	SSMH	2067096.57	6154342.96	317.68	10.8	306.9	10.8	306.9	8"VCP	10.5	307.2	8"VCP									
173	G6C4#200	49	SSMH	2061179.85	6183050.91	430.49	5.6	424.9	5.6	424.9	12"PVC	5.3	425.2	8"PVC	5.2	425.3	12"PVC						
174	F6D2#*200*	48	SSMH	2062185	6180471.07	440.42	7.5	432.9	7.5	432.9	8"PVC	7.4	433.0	8"PVC									
175	G6C2#400	50	SSMH	2061948	6183705.82	427.02	6.3	420.8	6.3	420.8	15"PVC	6.2	420.8	15"PVC									

Benchmark Ties:		North	East	Elev. (88)
	C972_RESET	2073155	6155536	333.2732
	TOWBMA	2076236	6163003	344.5831
	TOWBMB	2065382	6163595	351.4347
	ALACoBM	2064134	6154877	326.4576

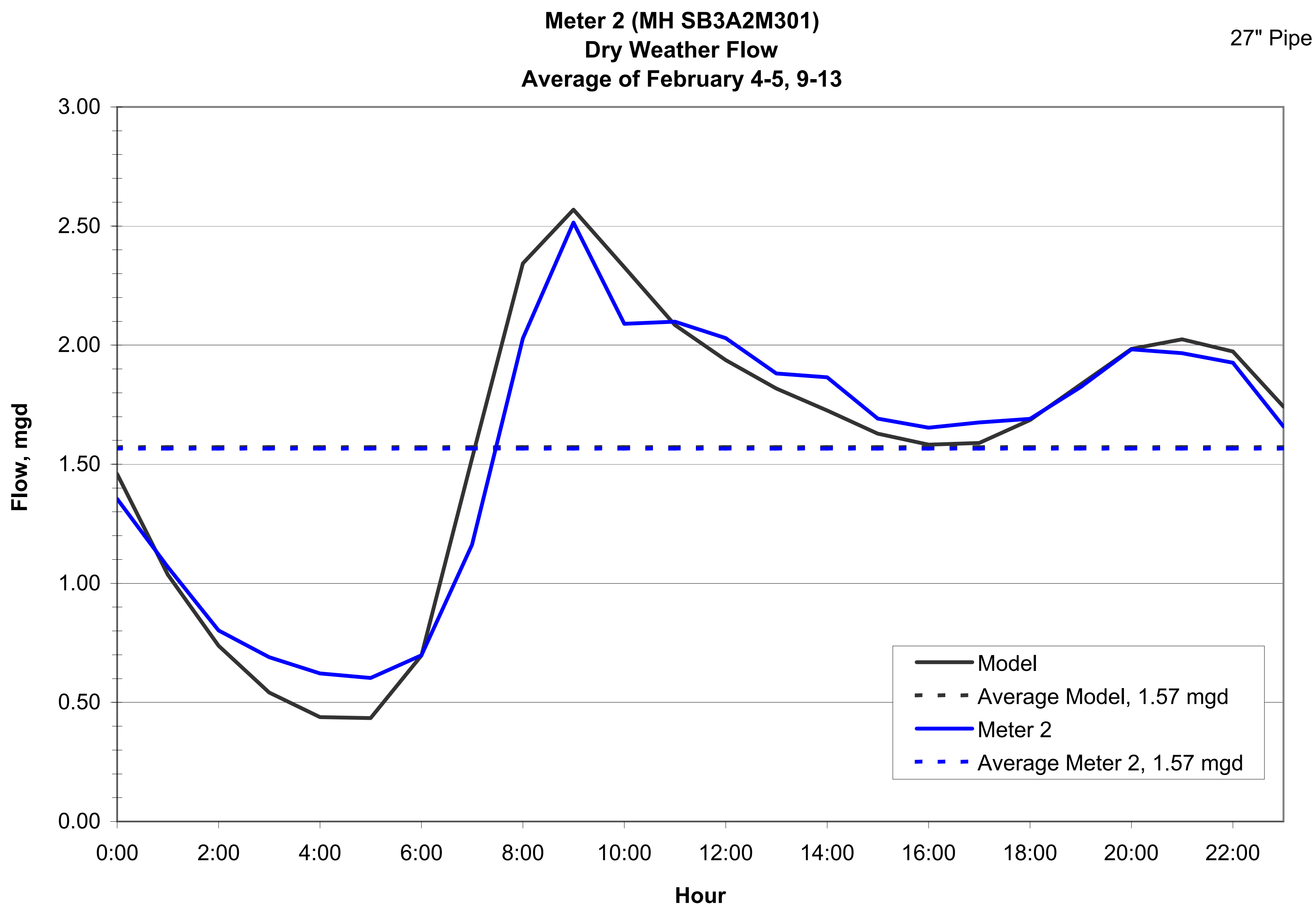
Note: to convert elevations from NAVD88 to NGVD29 subtract 2.65 feet.
(100.00 NAVD - 2.65 = 97.35 NGVD)

APPENDIX F - DRY WEATHER FLOW CALIBRATION PLOTS

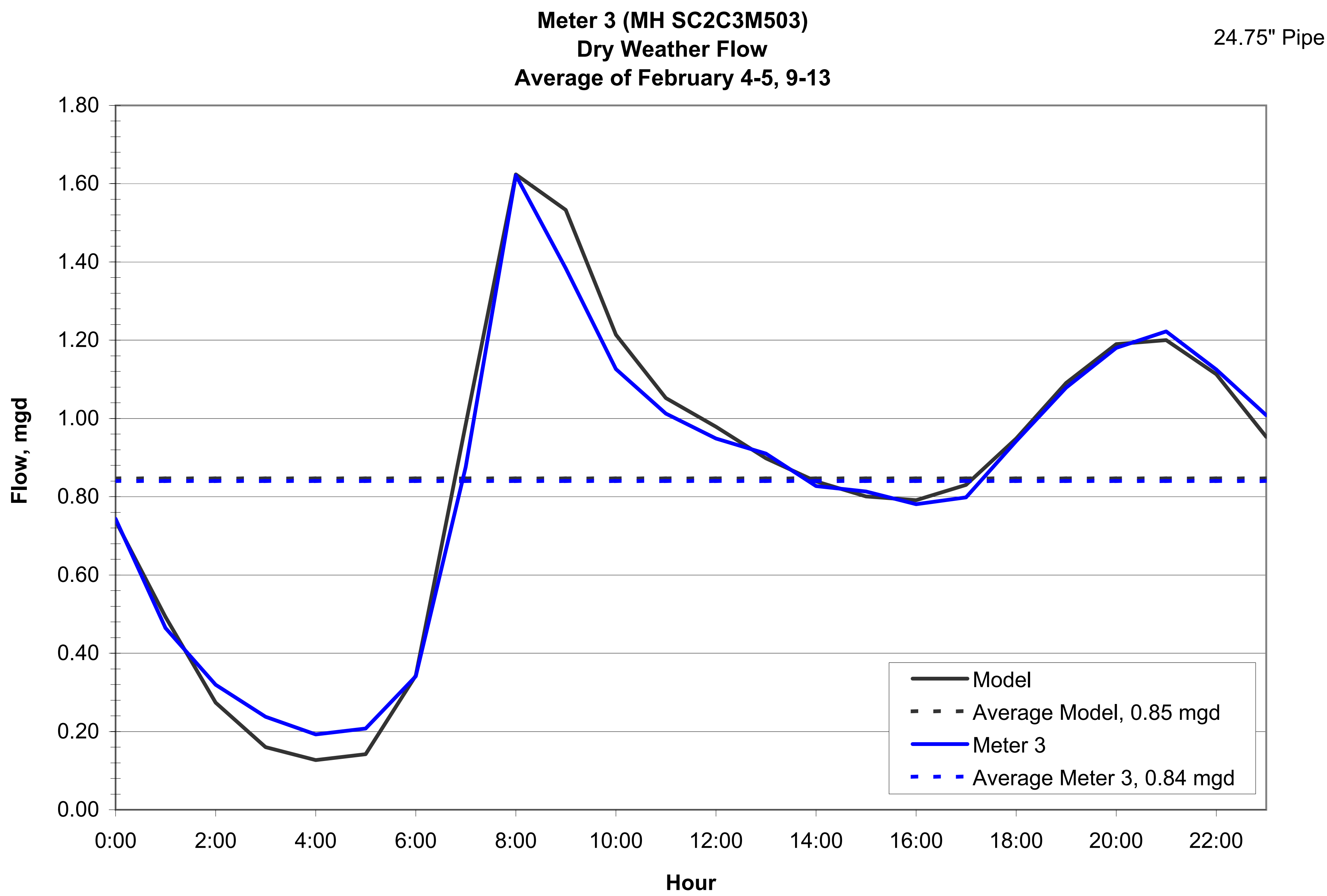
24" Pipe



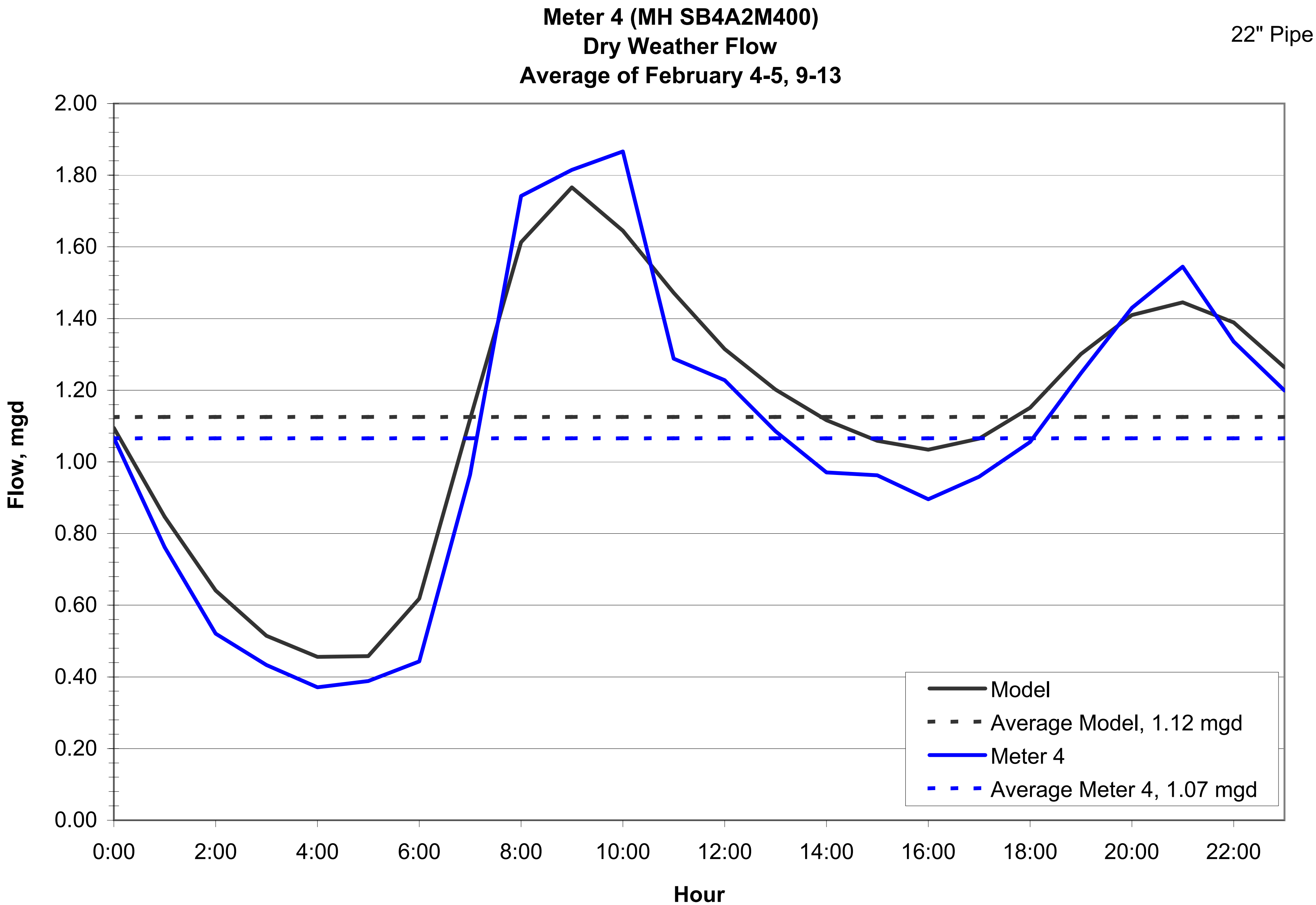
Meter 1 (MH SB3A1M408)
Dry Weather Flow
Average of February 4-5, 9-13
Flow, mgd
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.66 mgd
Meter 1
Average Meter 1, 0.68 mgd

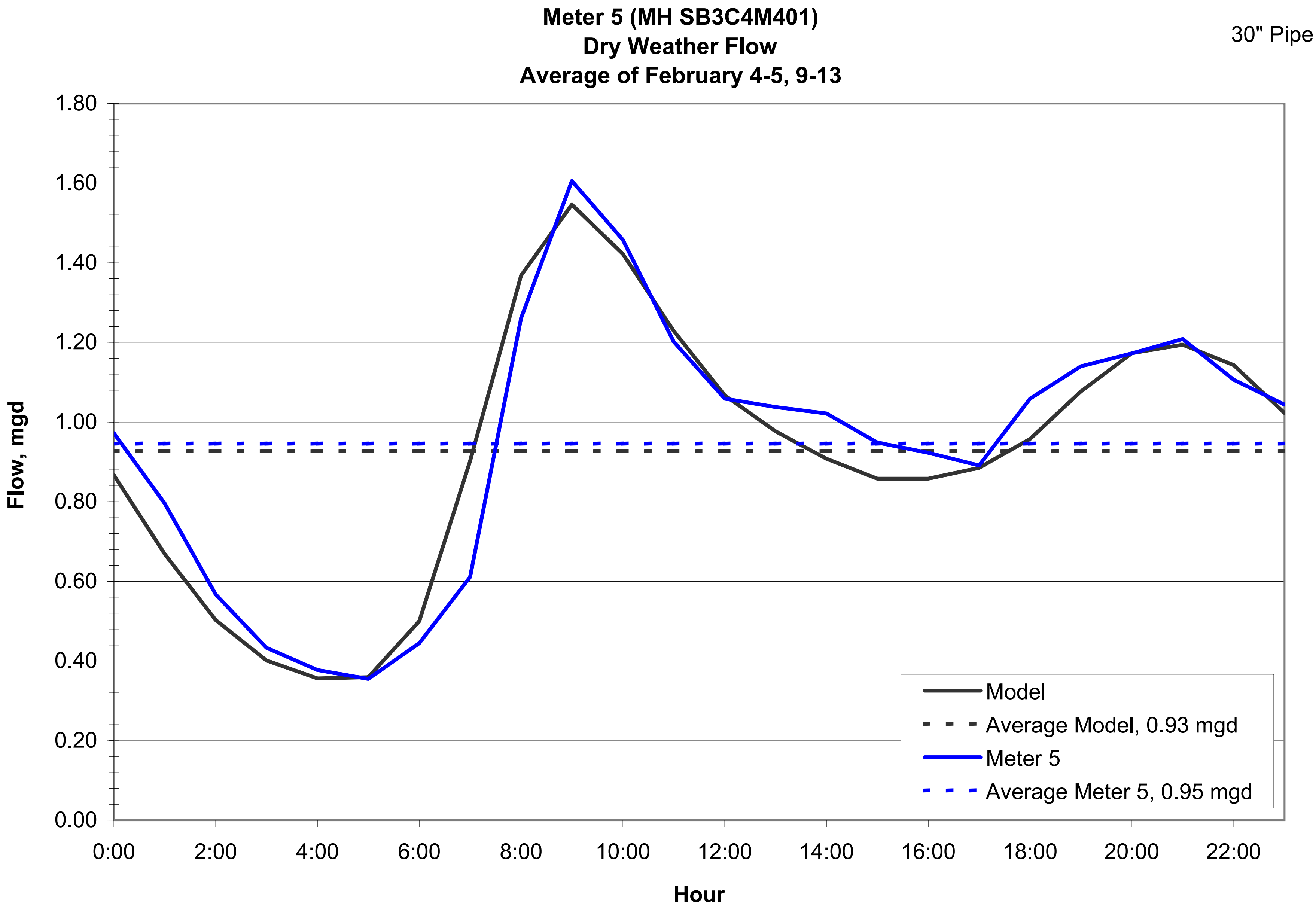


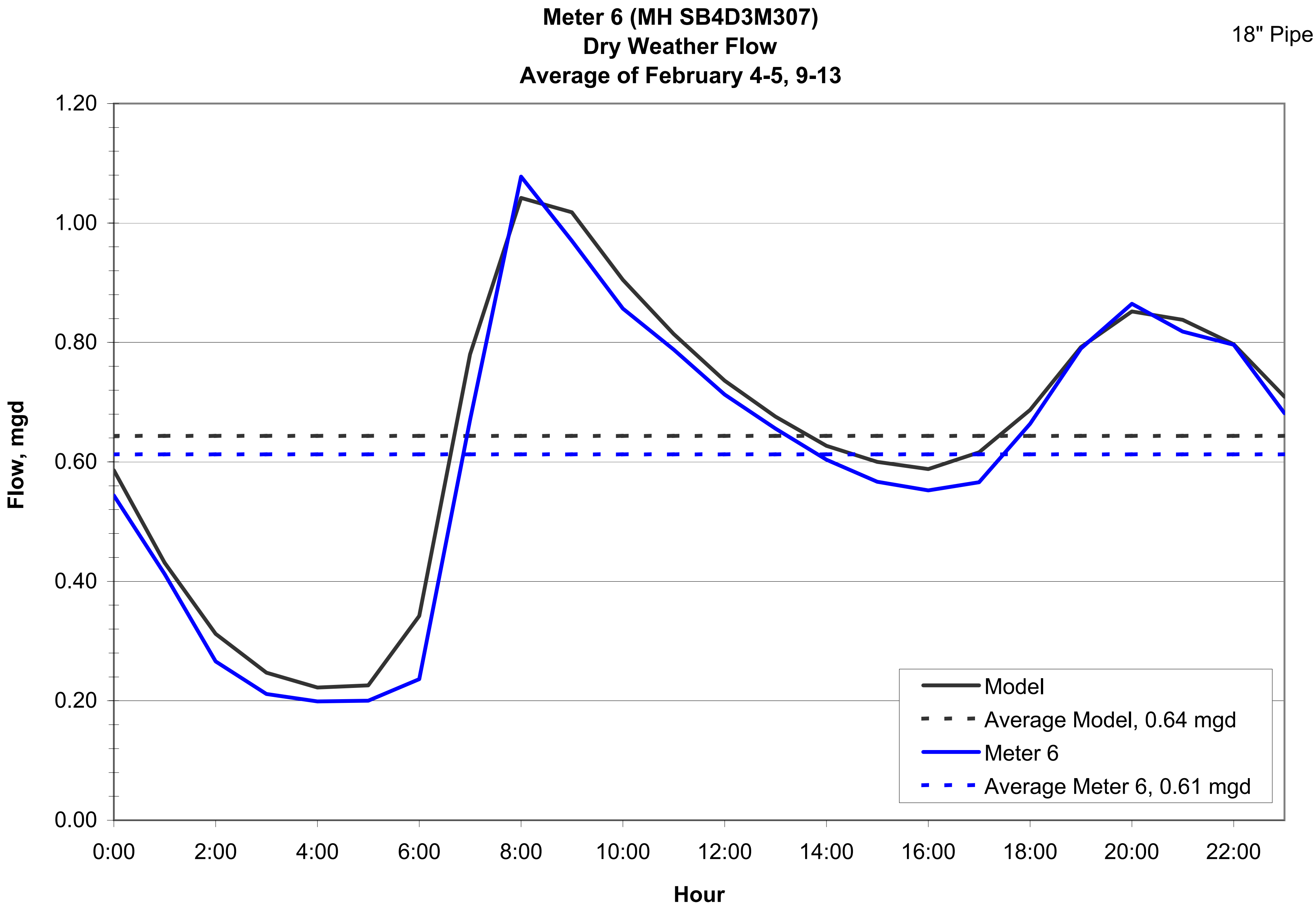
H:\Client\Pleasanton_WCO\6825A00\Task04-Hydraulic_Model\Calibration\DWF\DWF-M2.xls 7/2/2004

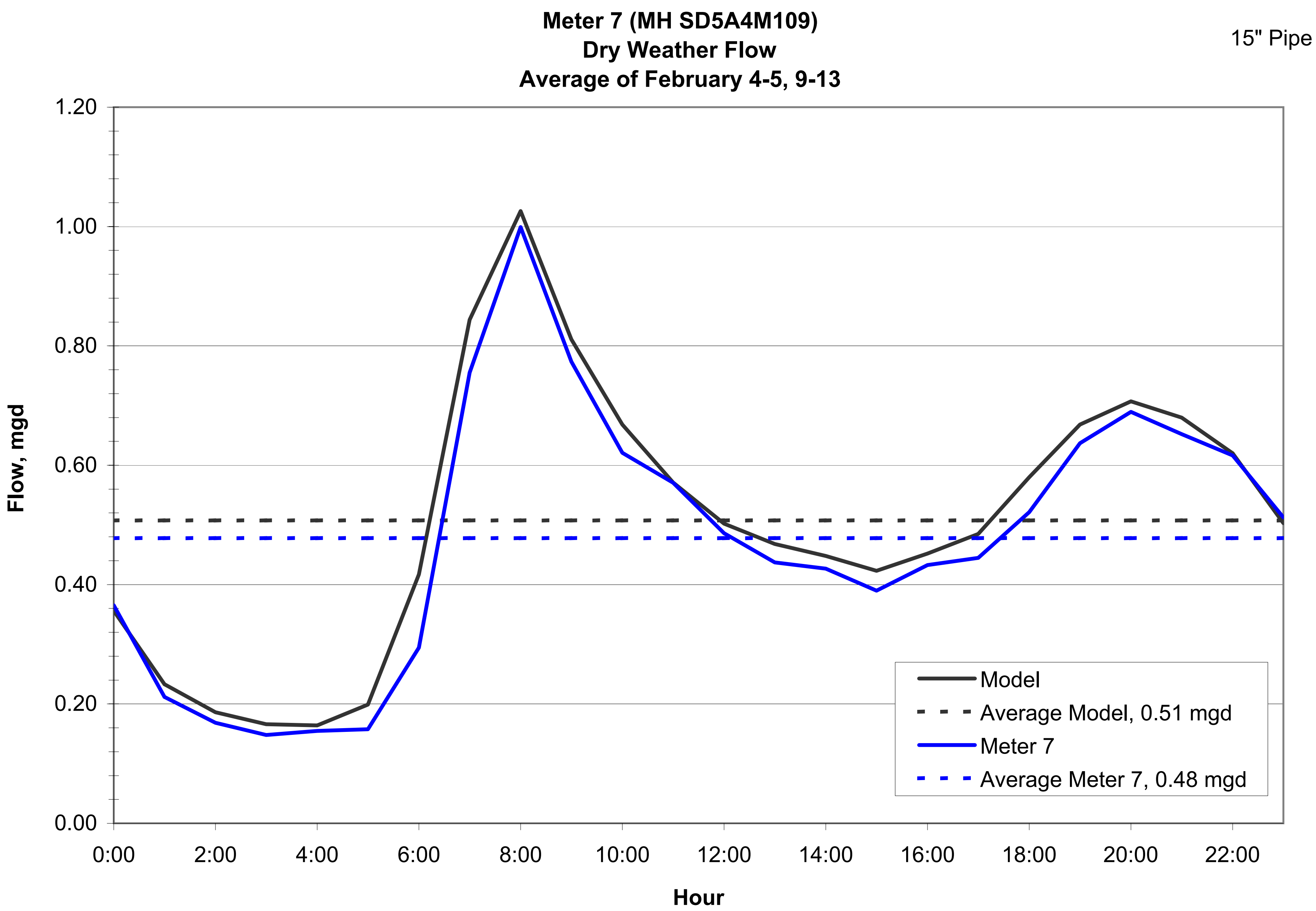


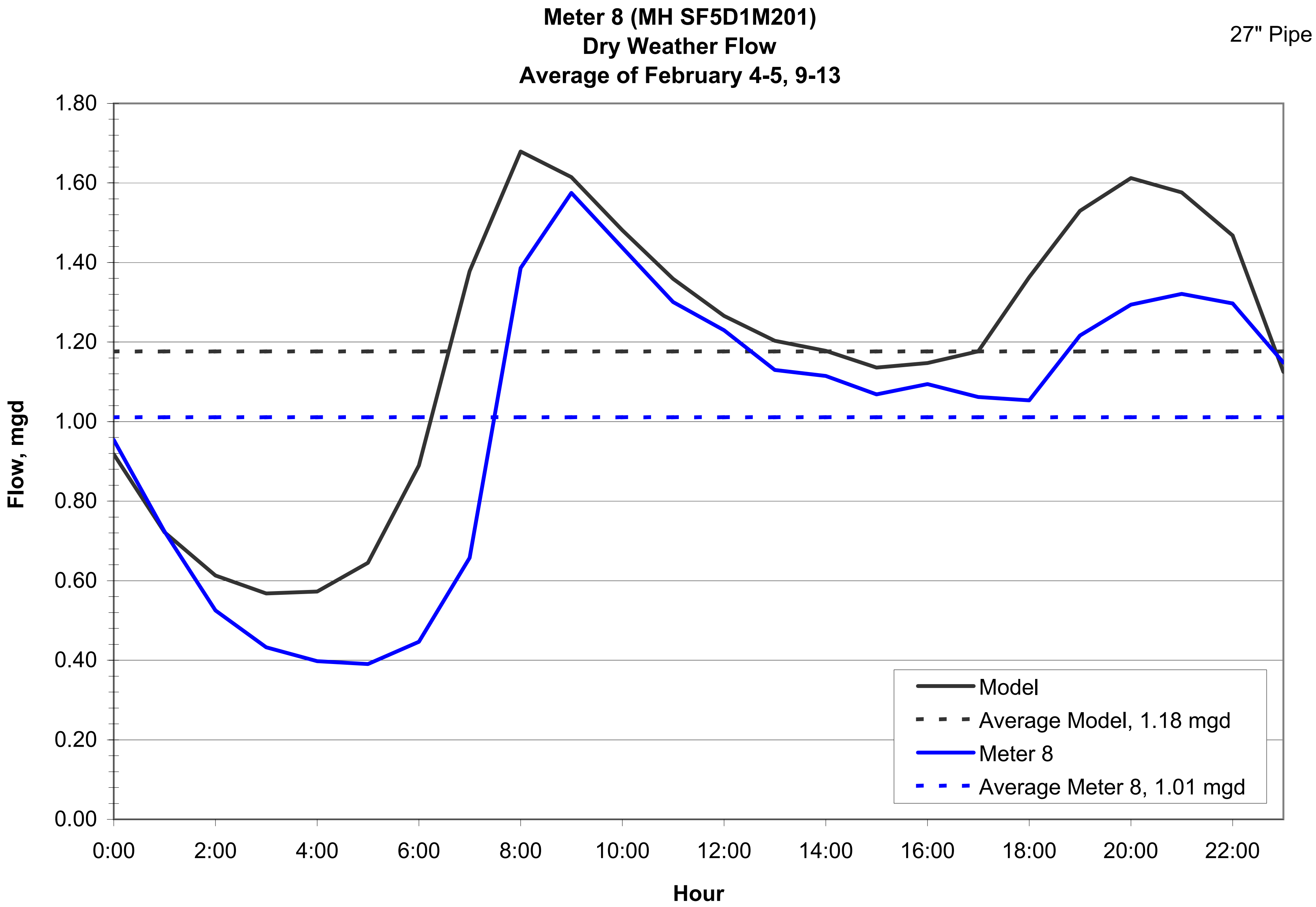
Meter 3 (MH SC2C3M503)
Dry Weather Flow
Average of February 4-5, 9-13
24.75" Pipe
Flow, mgd
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.85 mgd
Meter 3
Average Meter 3, 0.84 mgd

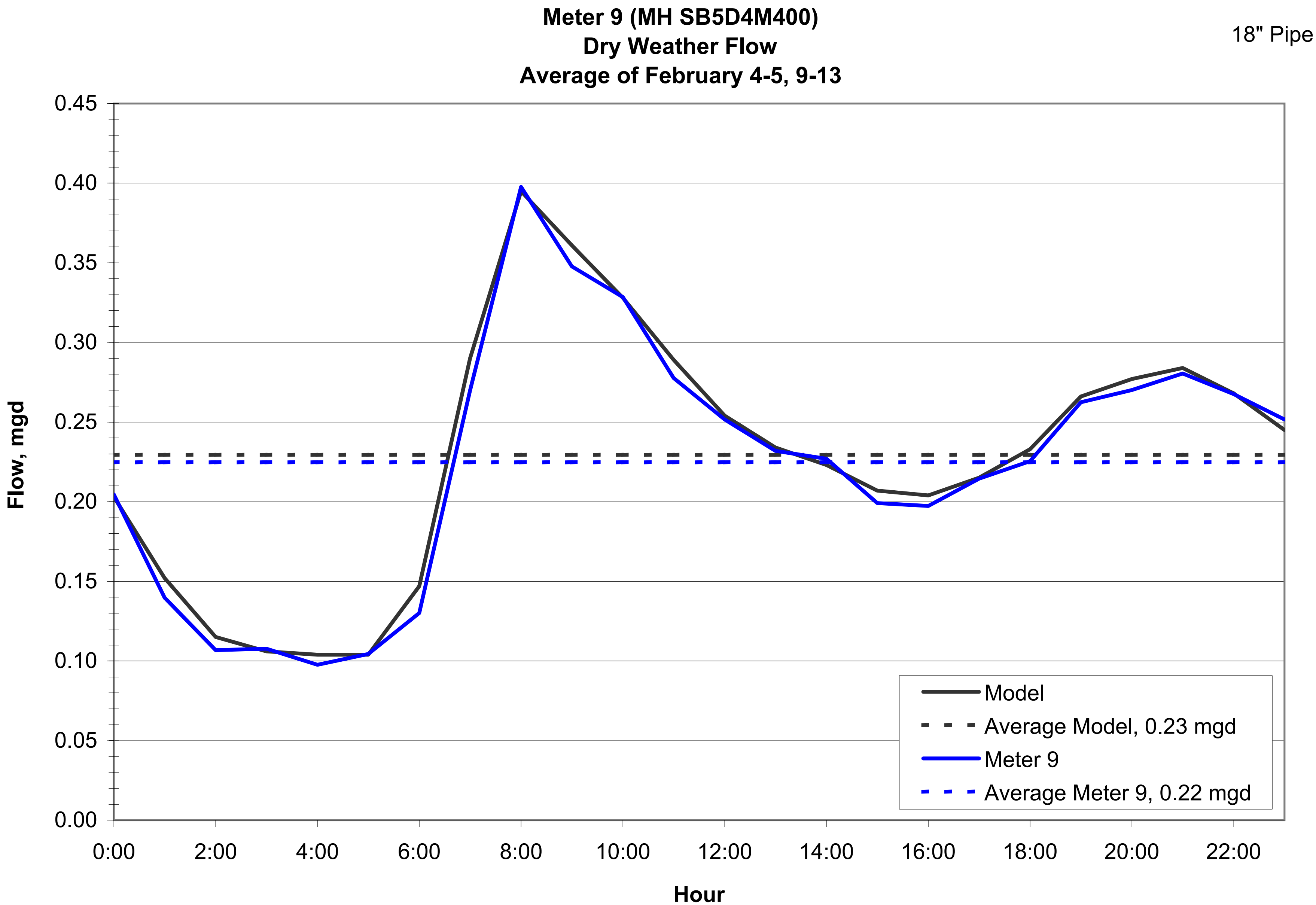

Meter 4 (MH SB4A2M400)
Dry Weather Flow
Average of February 4-5, 9-13
22" Pipe
Flow, mgd
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 1.12 mgd
Meter 4
Average Meter 4, 1.07 mgd

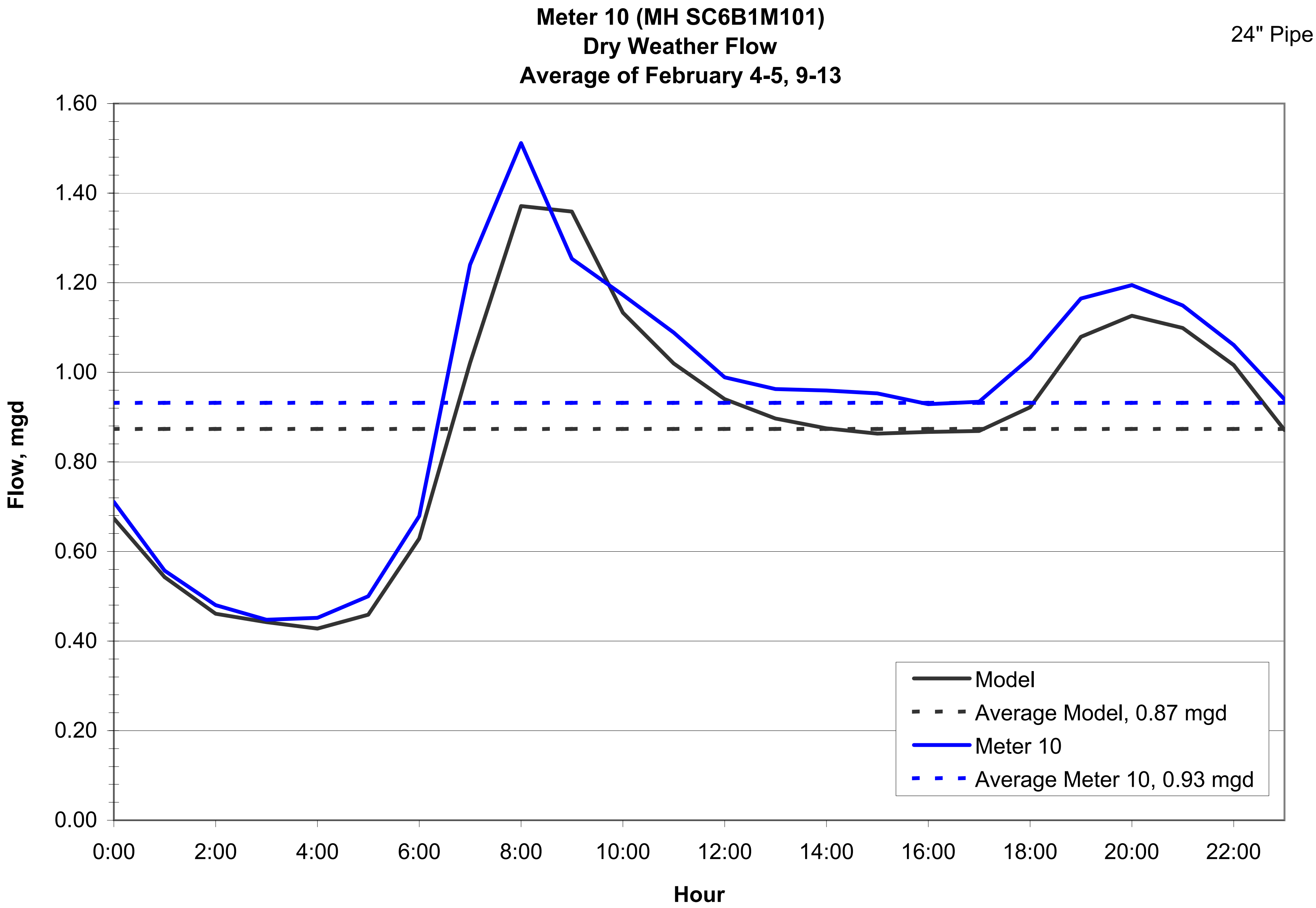

Meter 5 (MH SB3C4M401)
Dry Weather Flow
Average of February 4-5, 9-13
30" Pipe
Flow, mgd
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.93 mgd
Meter 5
Average Meter 5, 0.95 mgd

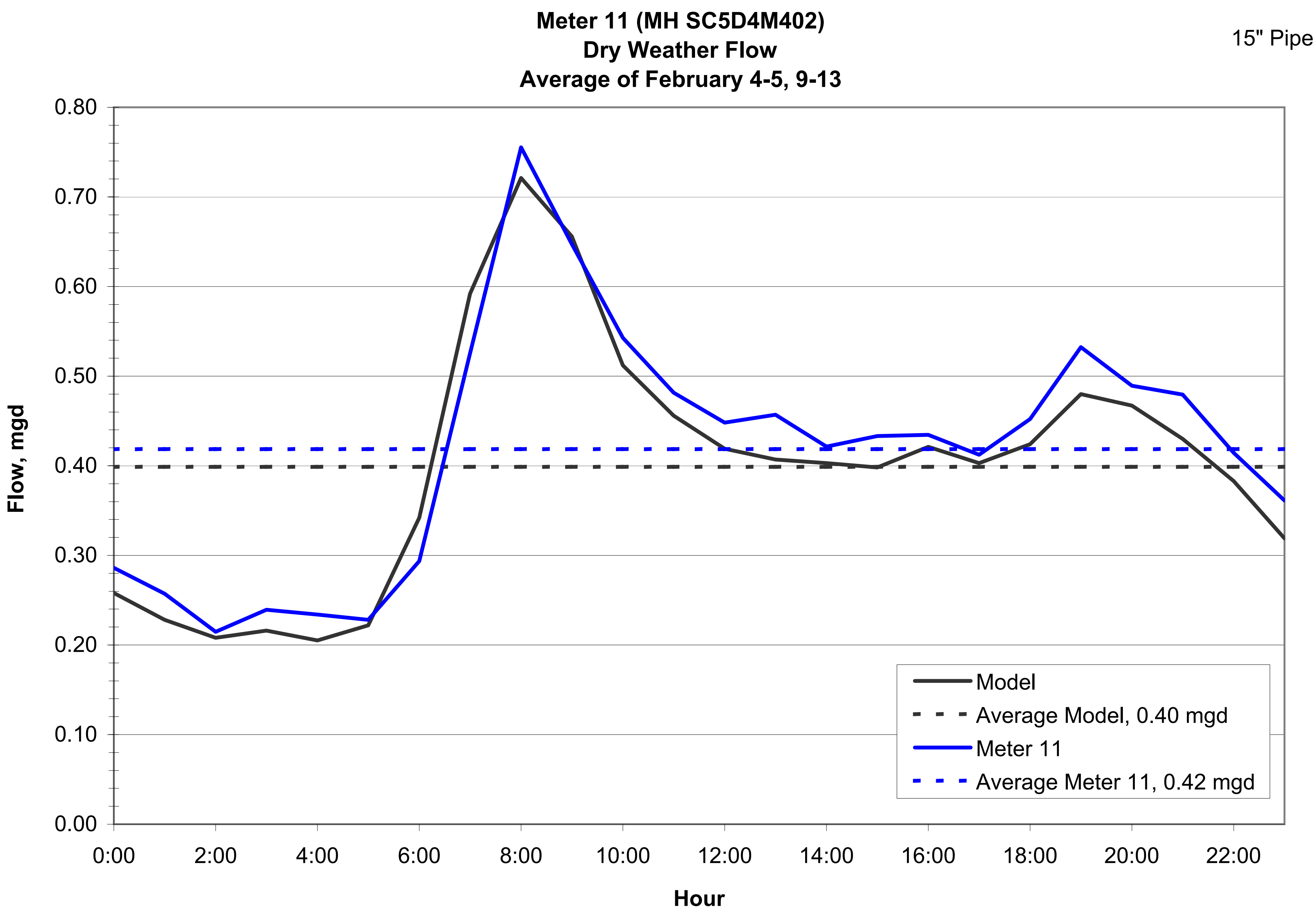

Meter 6 (MH SB4D3M307)
Dry Weather Flow
Average of February 4-5, 9-13
18" Pipe
Flow, mgd
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.64 mgd
Meter 6
Average Meter 6, 0.61 mgd


Meter 7 (MH SD5A4M109)
Dry Weather Flow
Average of February 4-5, 9-13
15" Pipe
Flow, mgd
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.51 mgd
Meter 7
Average Meter 7, 0.48 mgd

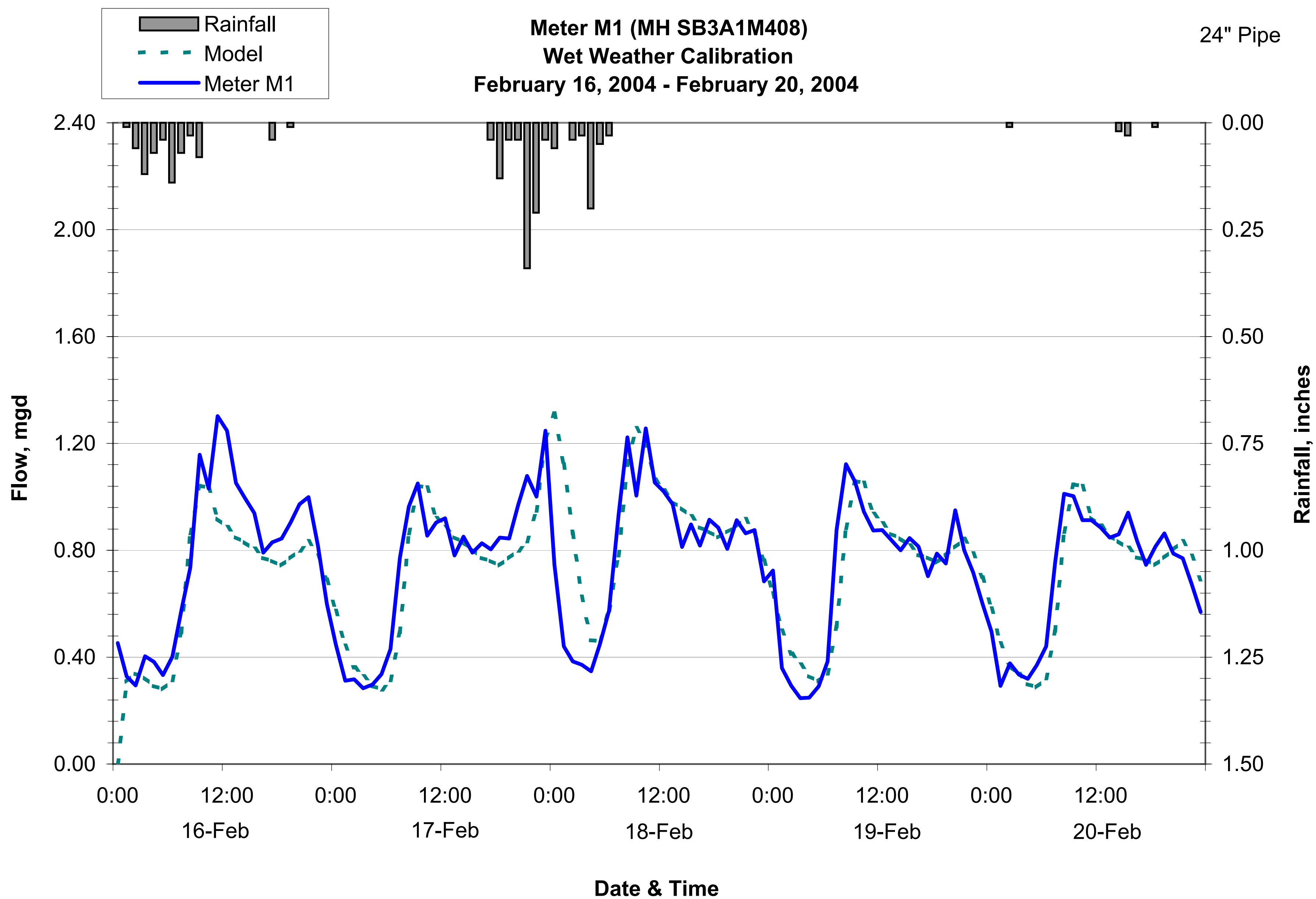

Meter 8 (MH SF5D1M201)
Dry Weather Flow
Average of February 4-5, 9-13
27" Pipe
Flow, mgd
Hour
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Model
Average Model, 1.18 mgd
Meter 8
Average Meter 8, 1.01 mgd


Meter 9 (MH SB5D4M400)
Dry Weather Flow
Average of February 4-5, 9-13
18" Pipe
Flow, mgd
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.23 mgd
Meter 9
Average Meter 9, 0.22 mgd

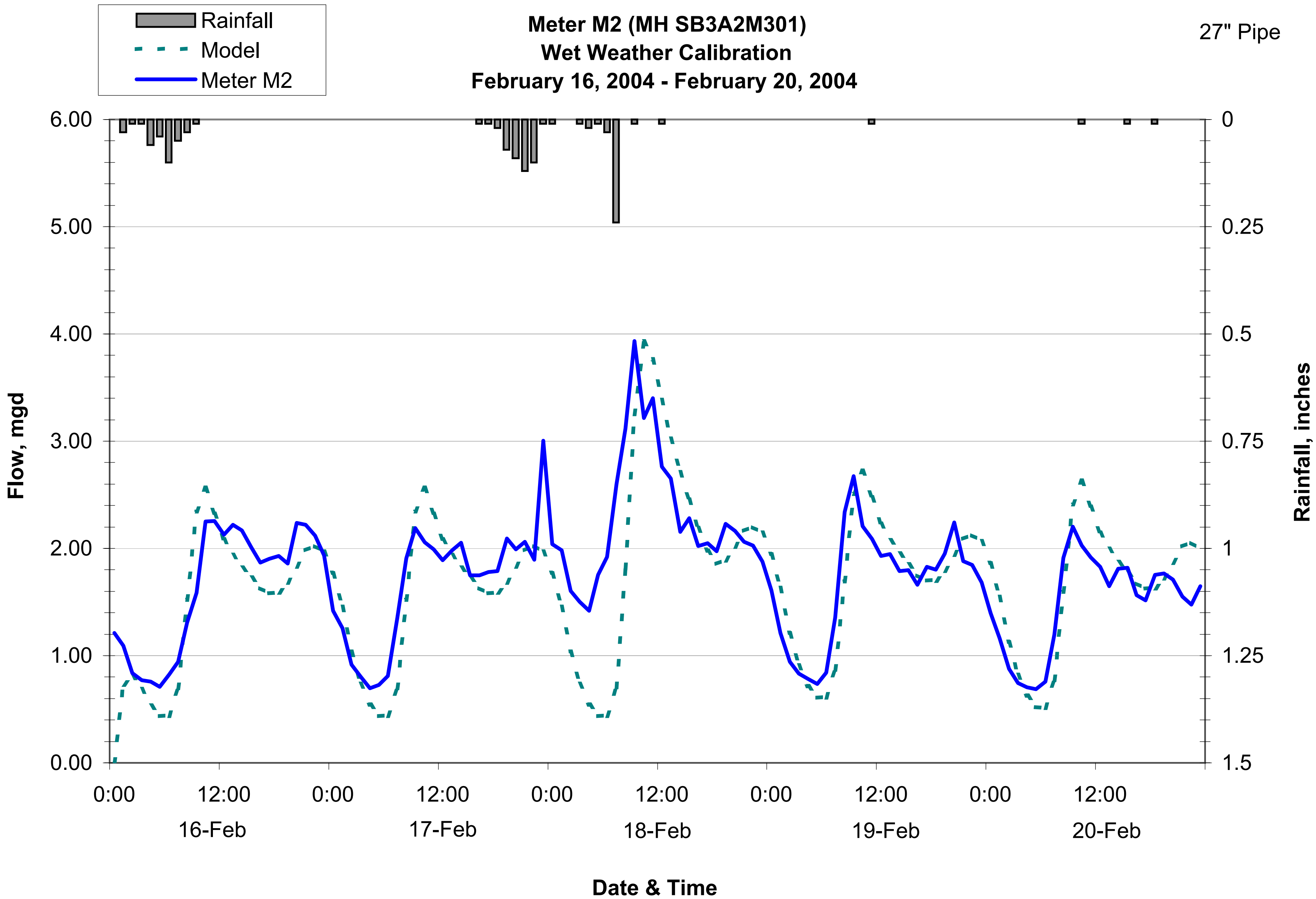

Meter 10 (MH SC6B1M101)
Dry Weather Flow
Average of February 4-5, 9-13
24" Pipe
Flow, mgd
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.87 mgd
Meter 10
Average Meter 10, 0.93 mgd


Meter 11 (MH SC5D4M402)
Dry Weather Flow
Average of February 4-5, 9-13
15" Pipe
Flow, mgd
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour
Model
Average Model, 0.40 mgd
Meter 11
Average Meter 11, 0.42 mgd

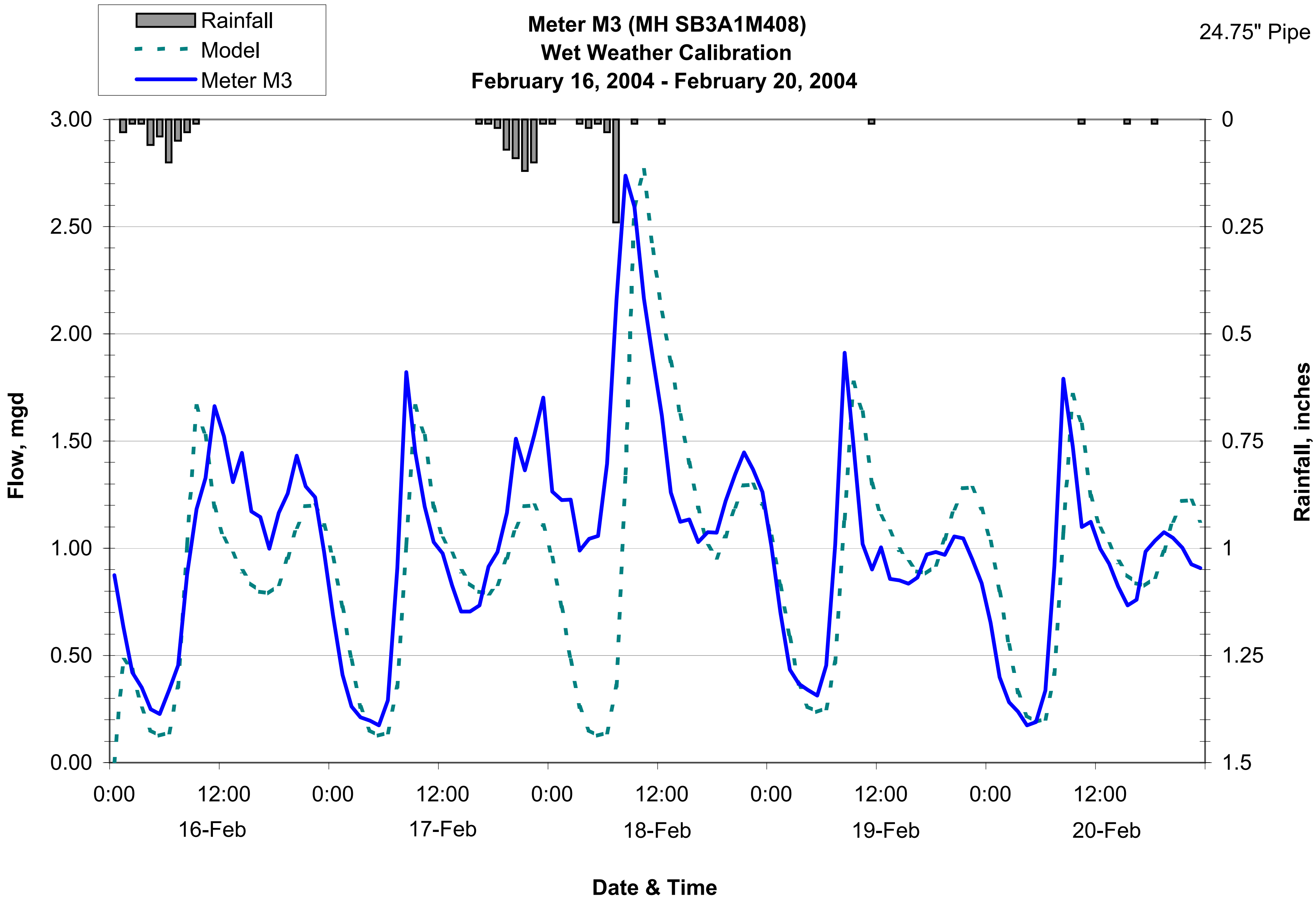
APPENDIX G - WET WEATHER FLOW CALIBRATION PLOTS (FEBRUARY 2004)



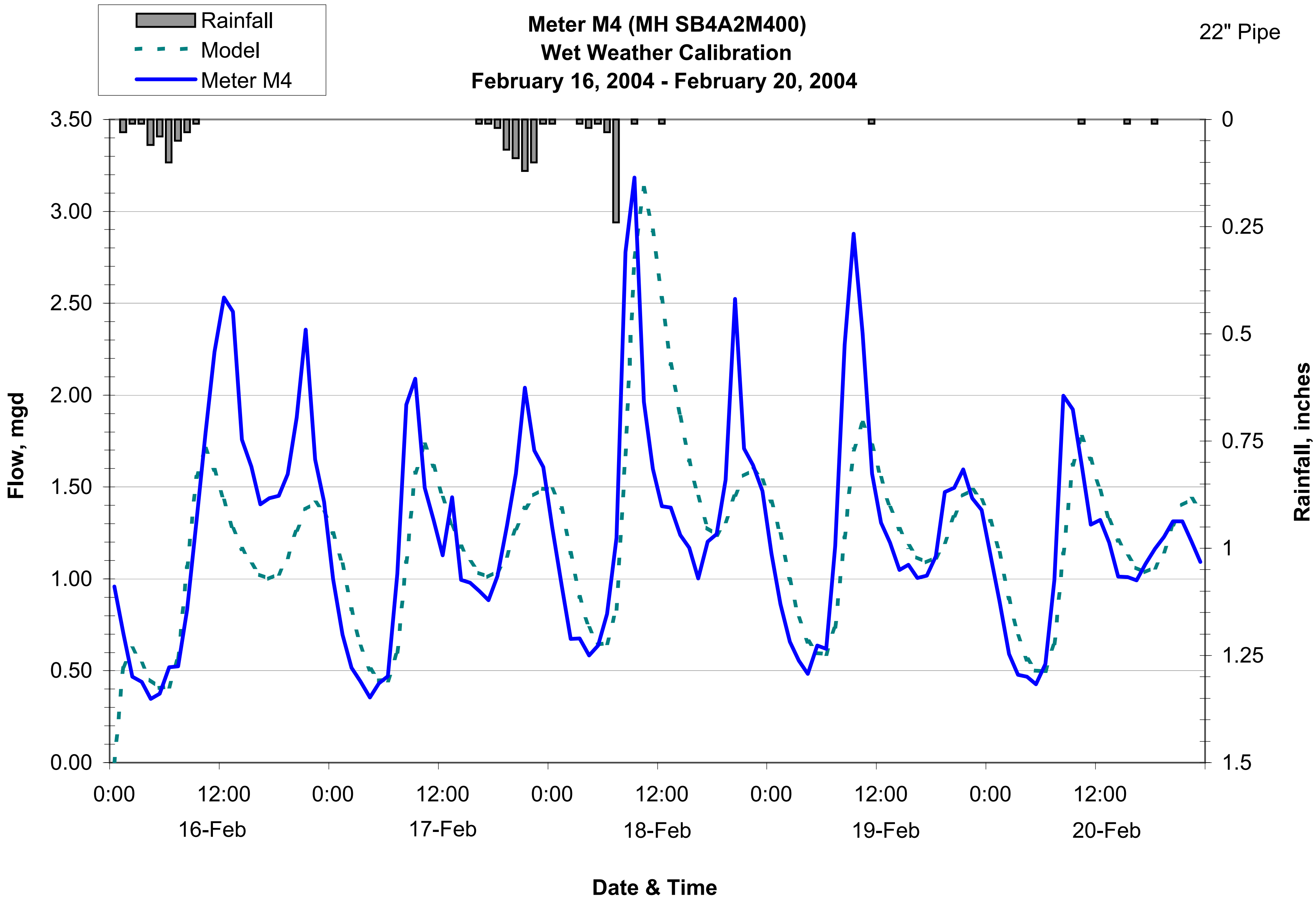
Rainfall
Model
Meter M1
Meter M1 (MH SB3A1M408)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
24" Pipe
2.40
2.00
1.60
1.20
0.80
0.40
0.00
0.00
0.25
0.50
0.75
1.00
1.25
1.50
Flow, mgd
Rainfall, inches
0:00
12:00
0:00
12:00
0:00
12:00
0:00
12:00
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time



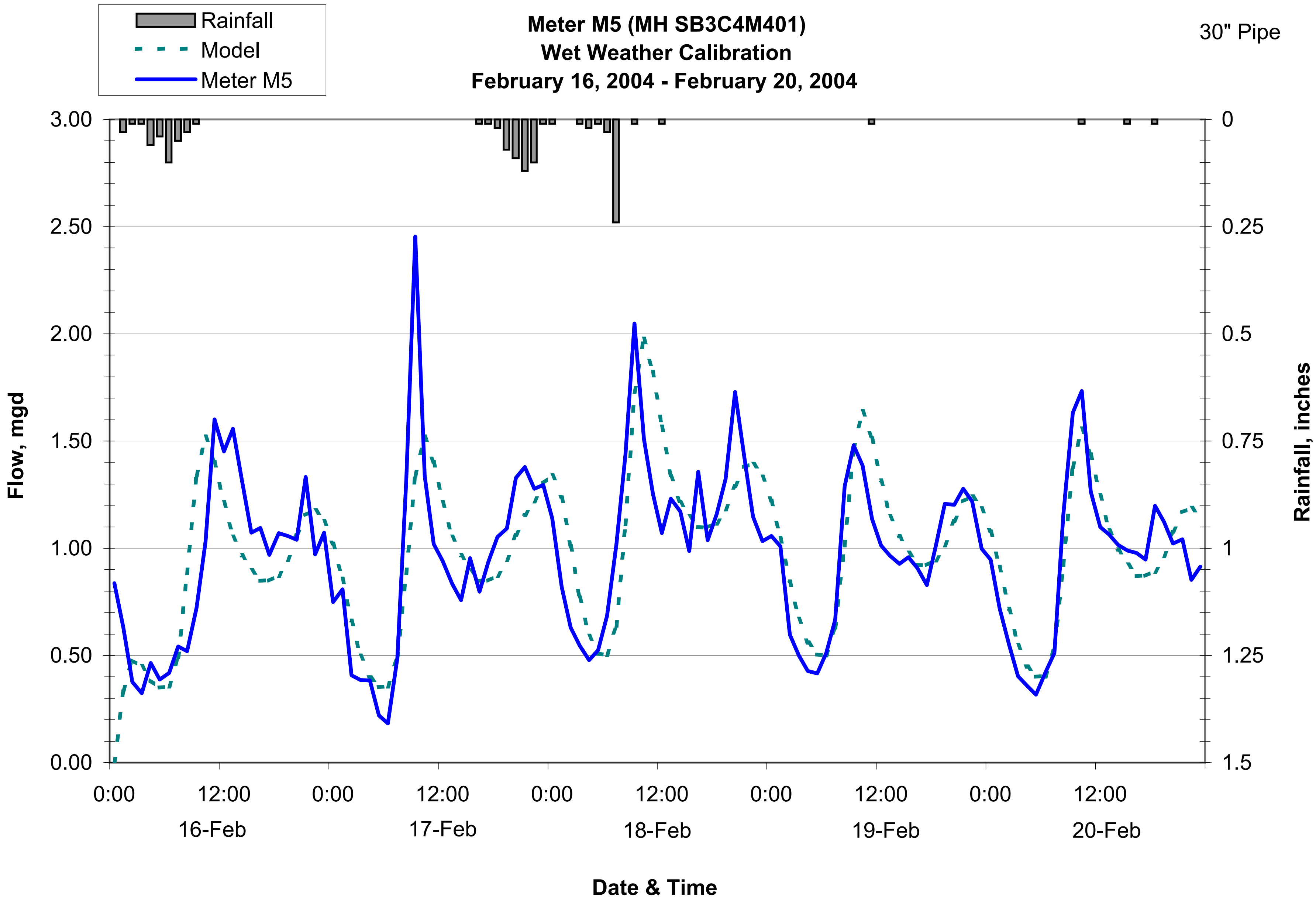
Rainfall
Model
Meter M2
Meter M2 (MH SB3A2M301)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
27" Pipe
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Flow, mgd
0
0.25
0.5
0.75
1
1.25
1.5
Rainfall, inches
0:00
12:00
0:00
12:00
0:00
12:00
0:00
12:00
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time



Meter M3 (MH SB3A1M408)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
24.75" Pipe
Rainfall
Model
Meter M3
Flow, mgd
Rainfall, inches
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time



Meter M4 (MH SB4A2M400)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
22" Pipe
Rainfall
Model
Meter M4
Flow, mgd
Rainfall, inches
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time



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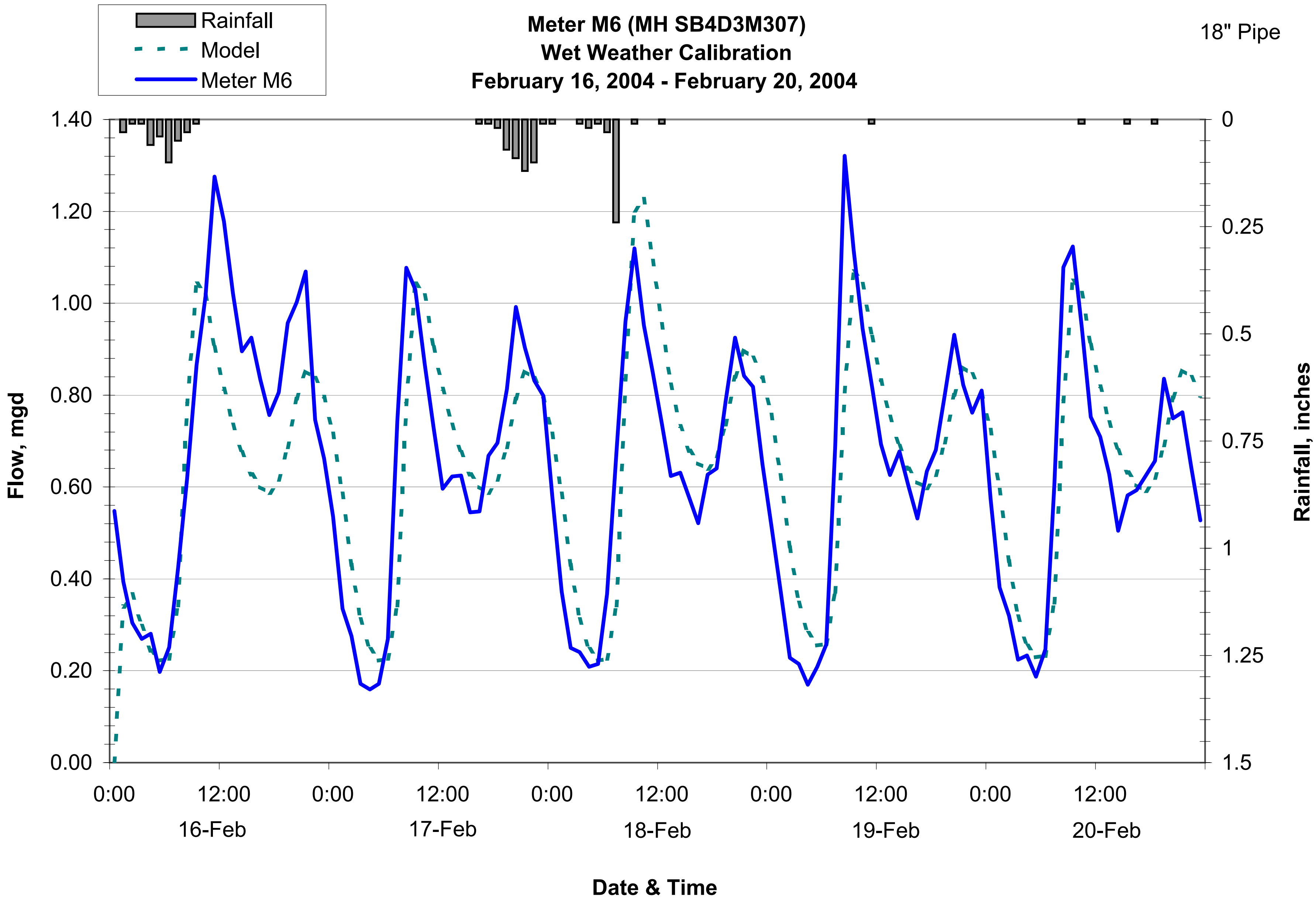
2/22/2006



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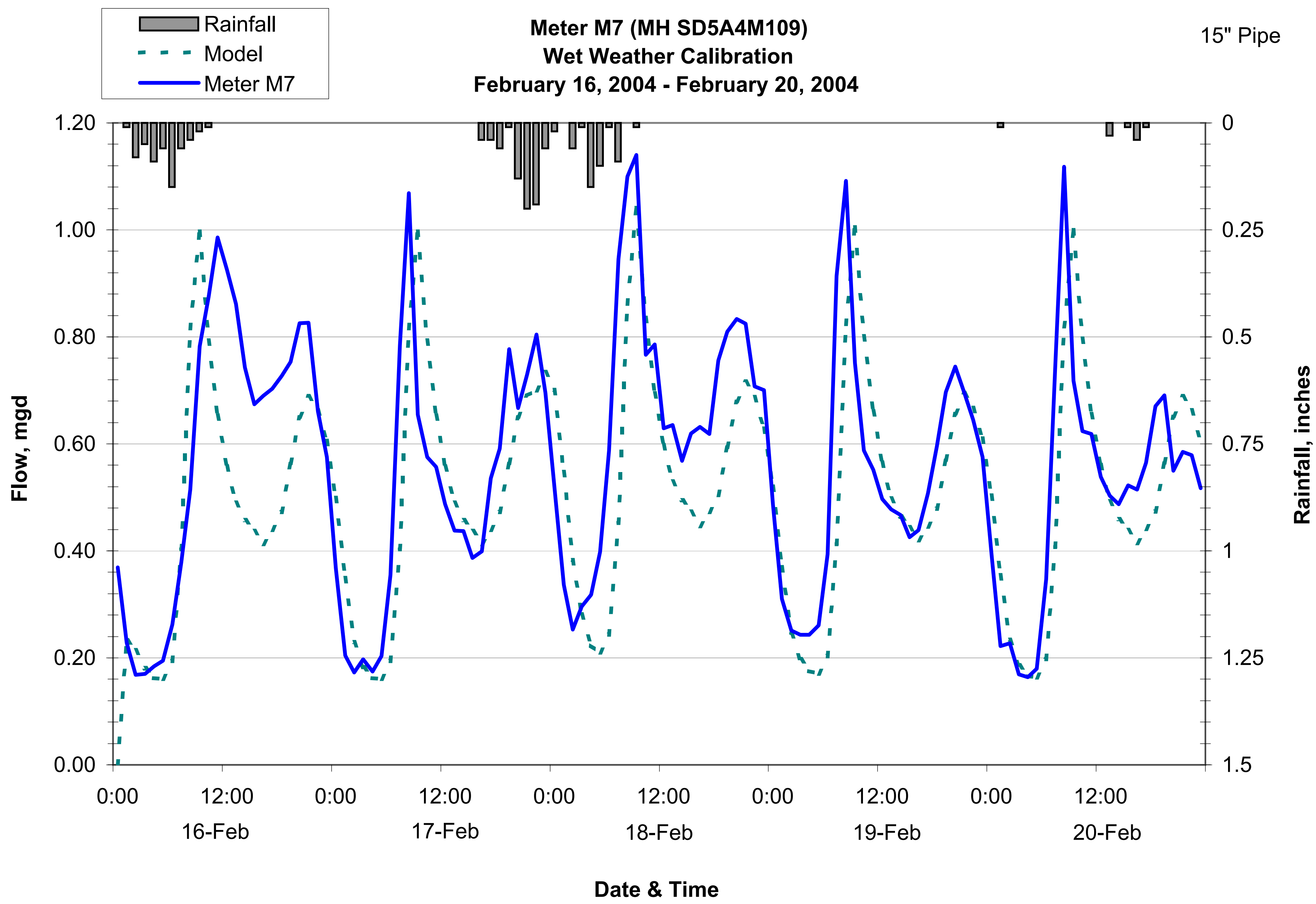
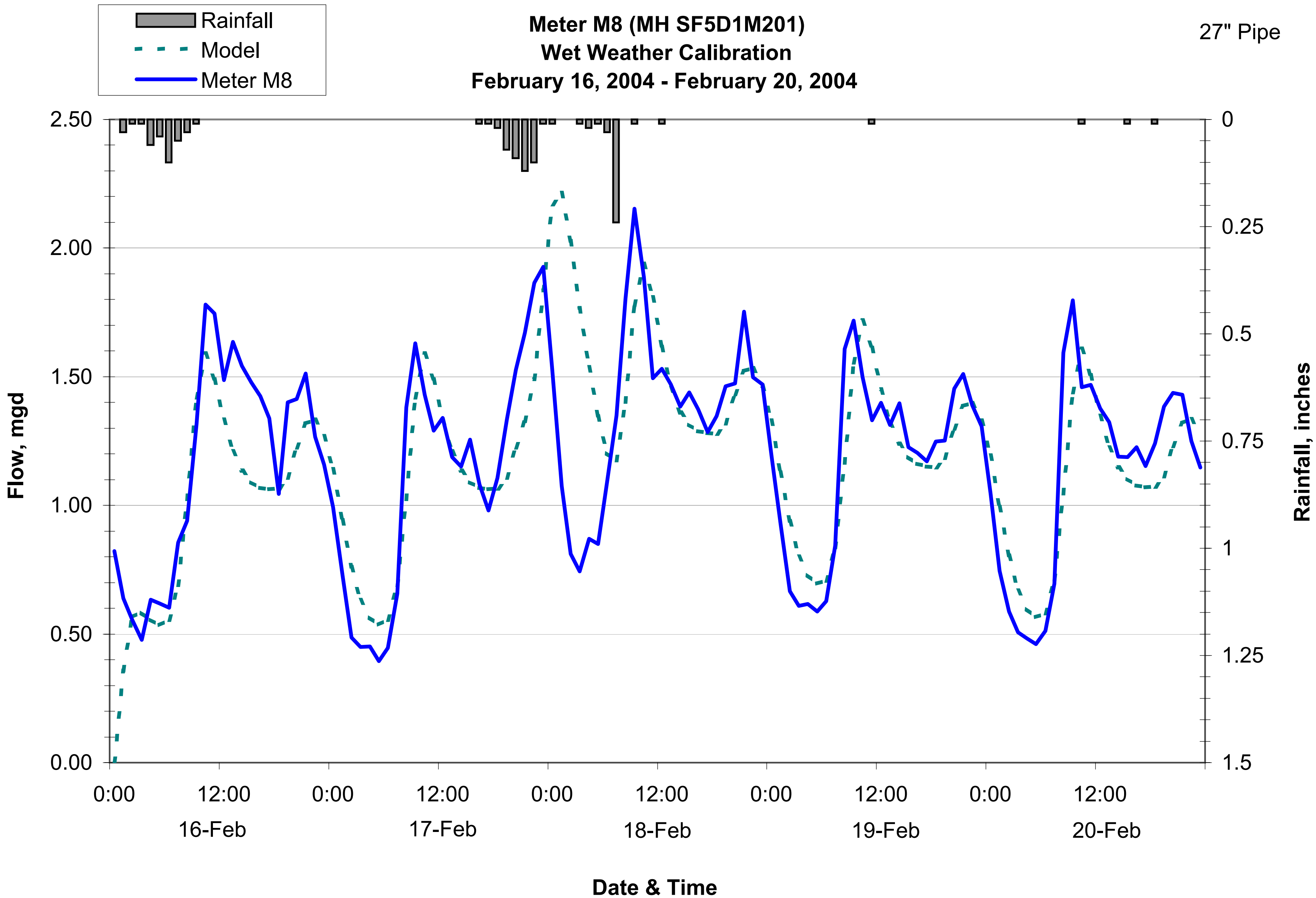
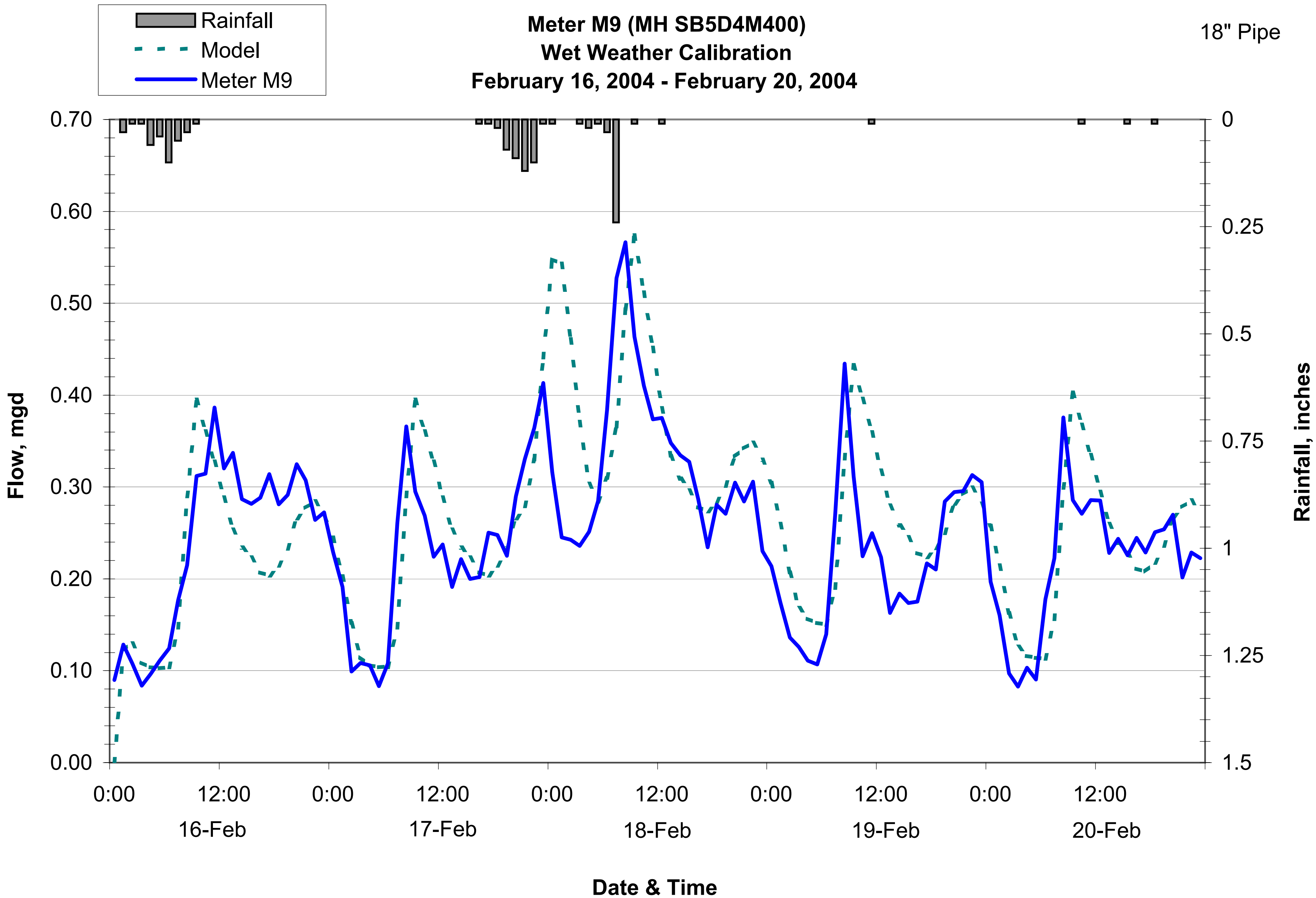
2/22/2006

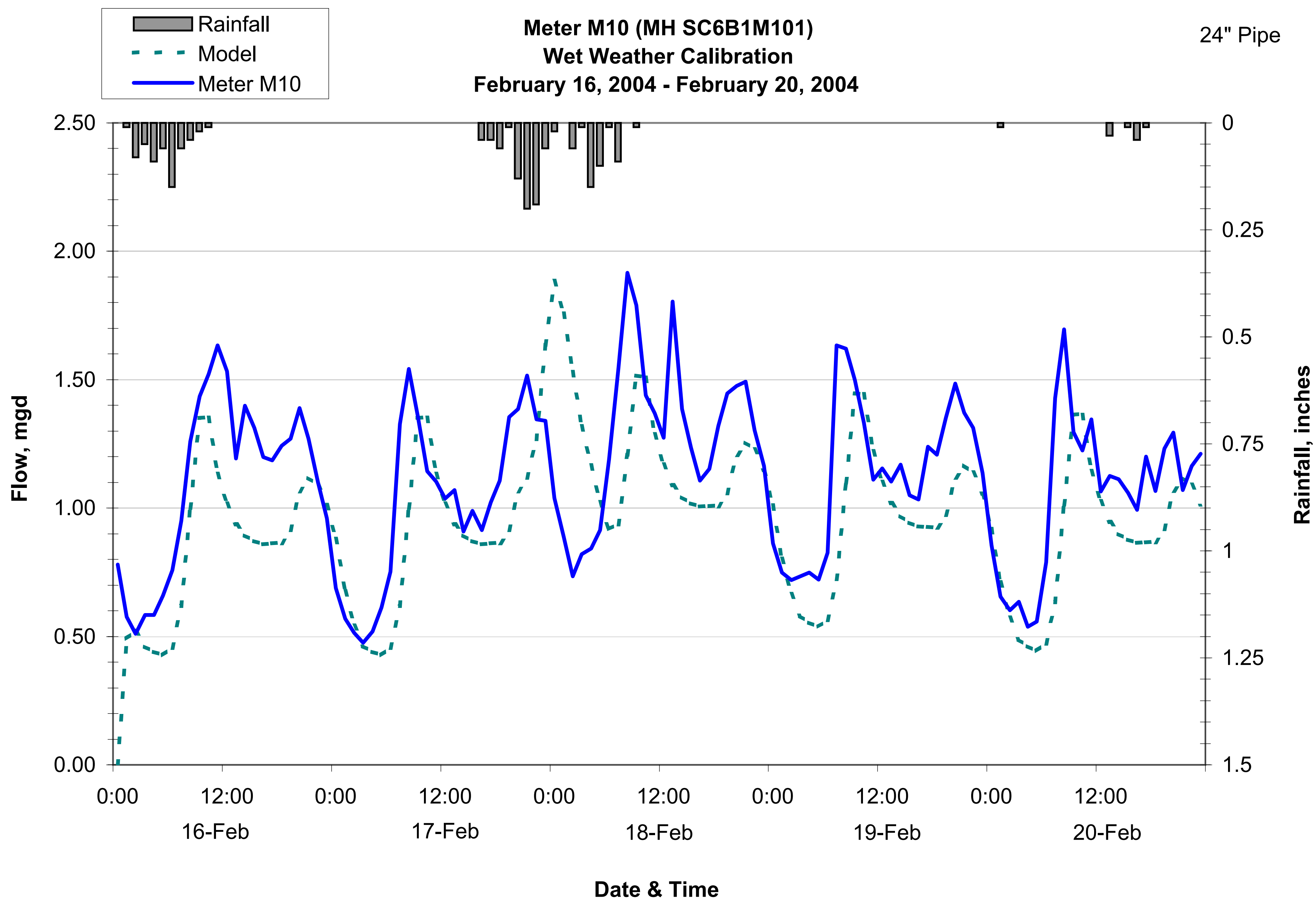


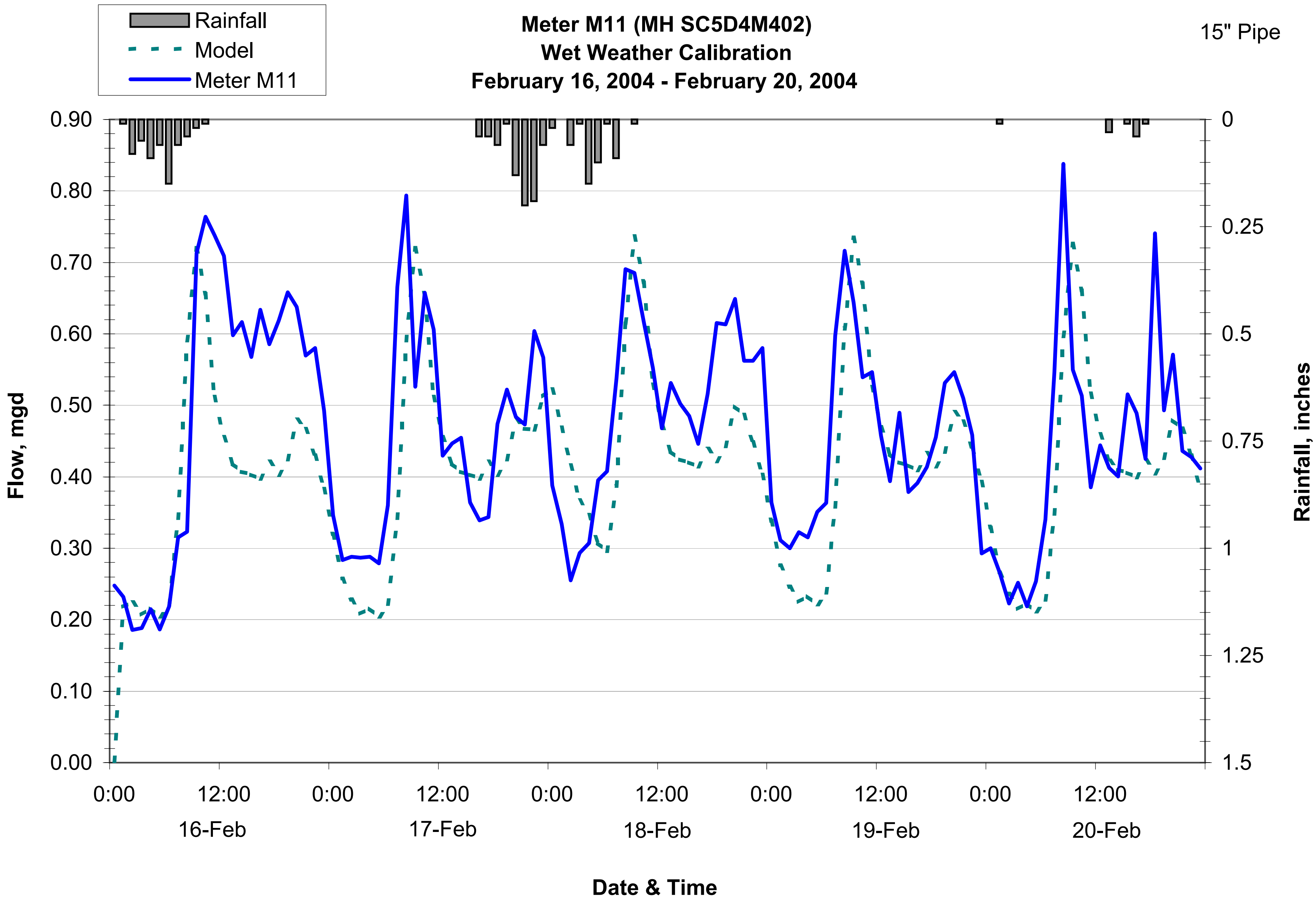
Rainfall
Model
Meter M7
Meter M7 (MH SD5A4M109)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
15" Pipe
Flow, mgd
Rainfall, inches
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time


Rainfall
Model
Meter M8
Meter M8 (MH SF5D1M201)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
27" Pipe
Flow, mgd
Rainfall, inches
2.50
2.00
1.50
1.00
0.50
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time



Rainfall
Model
Meter M9
Meter M9 (MH SB5D4M400)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
18" Pipe
Flow, mgd
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Rainfall, inches
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time

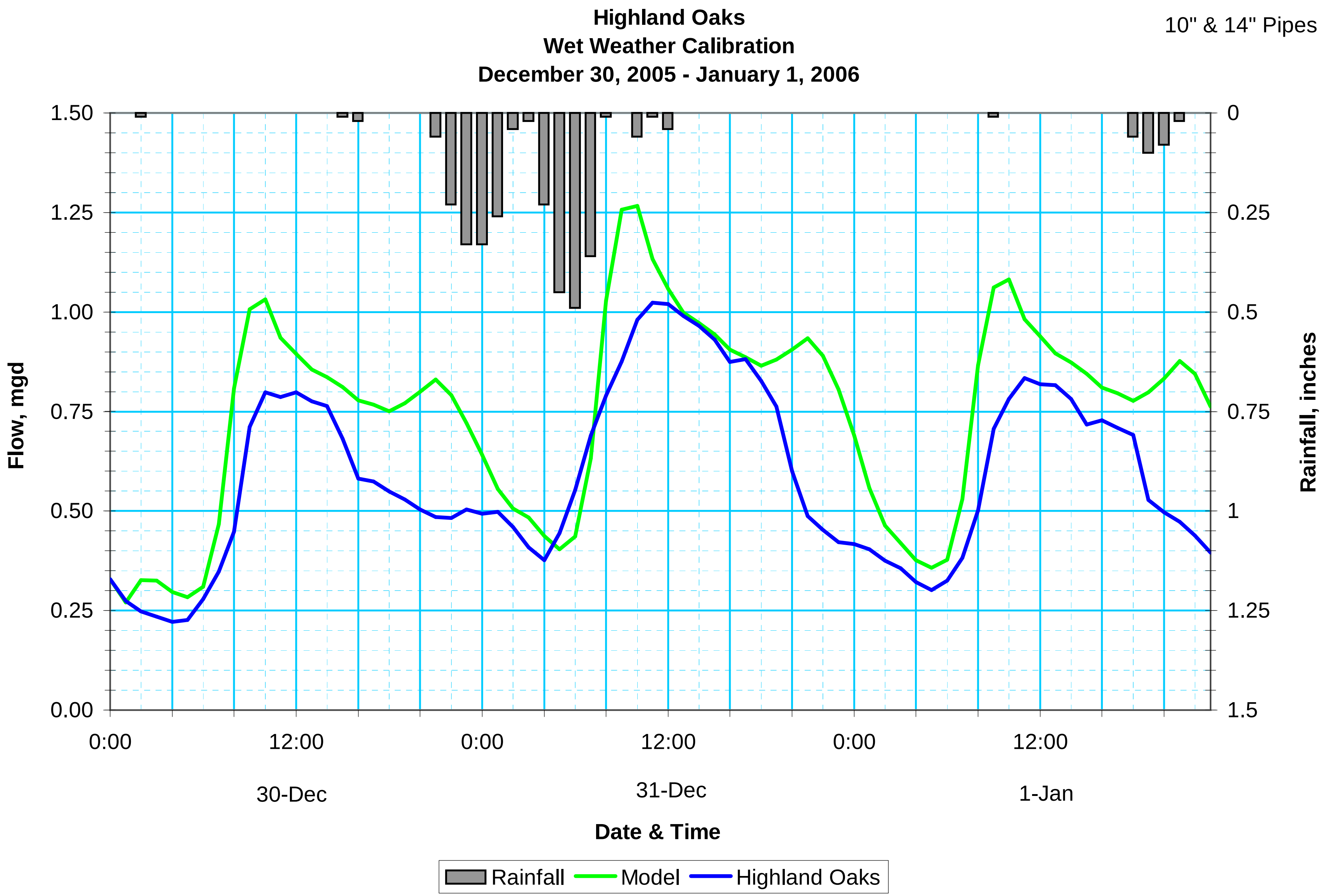

Rainfall
Model
Meter M10
Meter M10 (MH SC6B1M101)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
24" Pipe
Flow, mgd
Rainfall, inches
Date & Time
2.50
2.00
1.50
1.00
0.50
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb



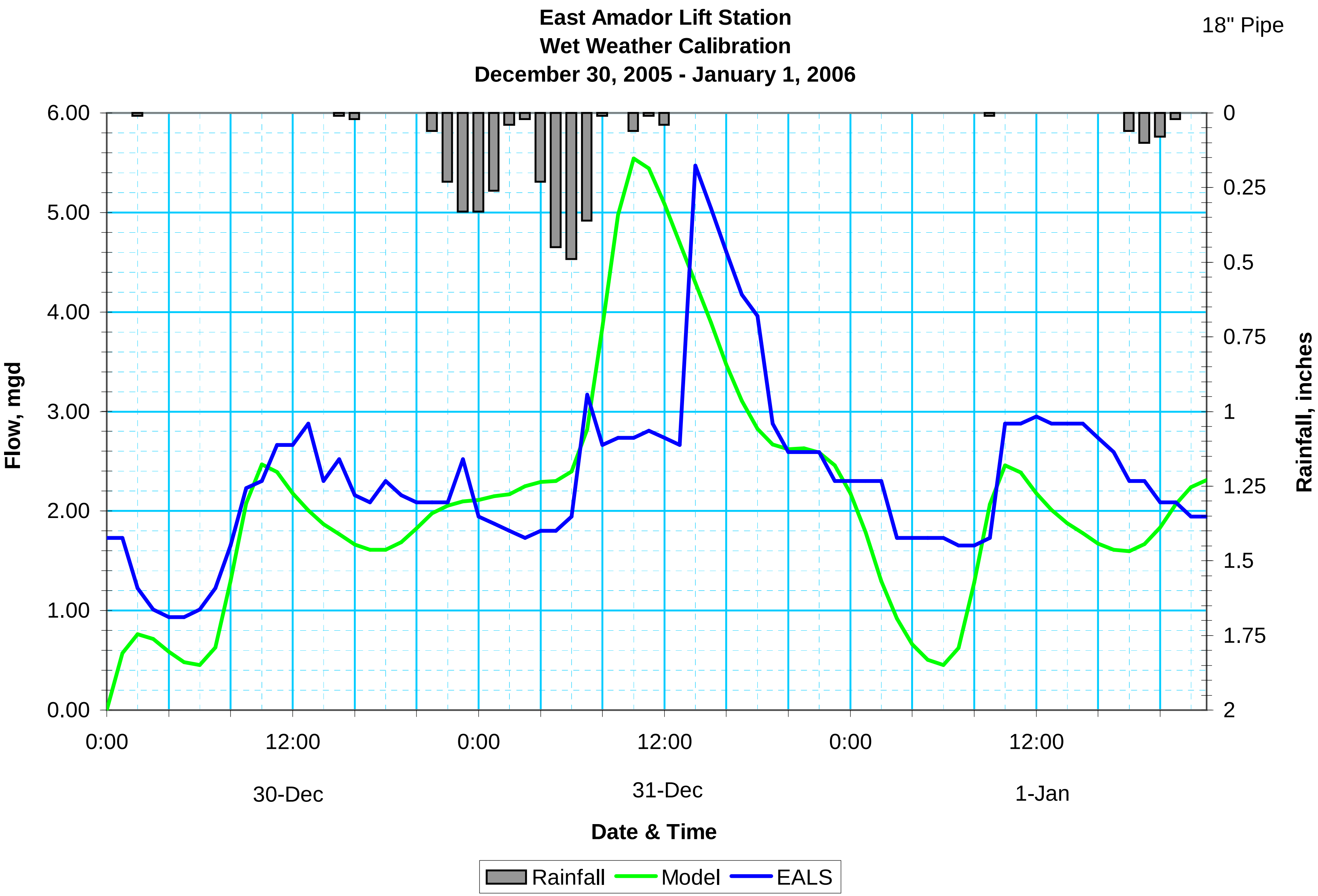
Rainfall
Model
Meter M11
Meter M11 (MH SC5D4M402)
Wet Weather Calibration
February 16, 2004 - February 20, 2004
15" Pipe
Flow, mgd
Rainfall, inches
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
16-Feb
17-Feb
18-Feb
19-Feb
20-Feb
Date & Time

APPENDIX H - WET WEATHER FLOW CALIBRATION PLOTS (DECEMBER 2005)

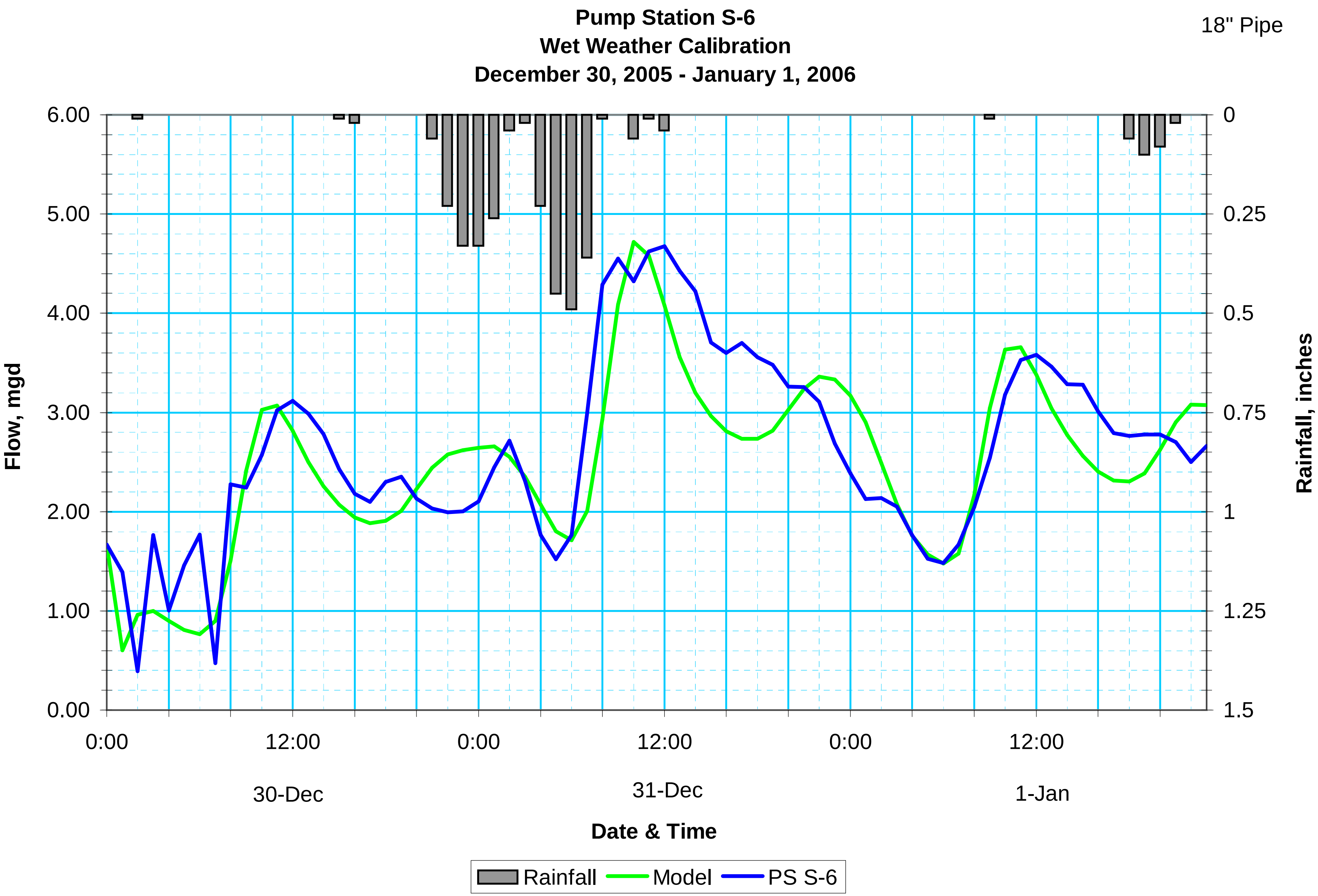
10" & 14" Pipes



Highland Oaks
Wet Weather Calibration
December 30, 2005 - January 1, 2006
Flow, mgd
Rainfall, inches
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
0.25
0.5
0.75
1
1.25
1.5
0:00
12:00
0:00
12:00
0:00
12:00
30-Dec
31-Dec
1-Jan
Date & Time
Rainfall
Model
Highland Oaks



East Amador Lift Station
Wet Weather Calibration
December 30, 2005 - January 1, 2006
18" Pipe
Flow, mgd
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Rainfall, inches
0
0.25
0.5
0.75
1
1.25
1.5
1.75
2
0:00
12:00
0:00
12:00
0:00
12:00
30-Dec
31-Dec
1-Jan
Date & Time
Rainfall
Model
EALS



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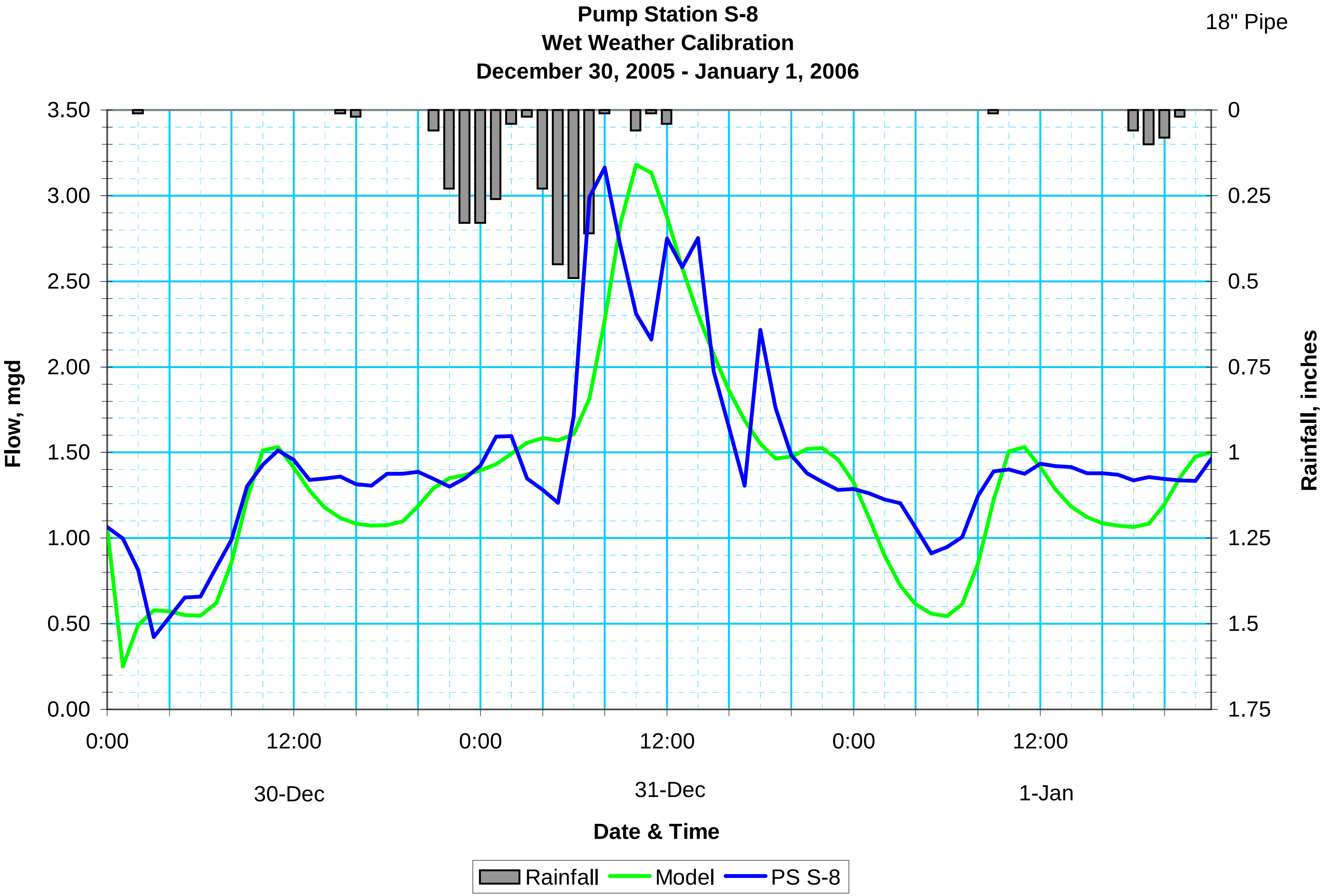
8/7/2007


Pump Station S-8
Wet Weather Calibration
December 30, 2005 - January 1, 2006
18" Pipe
Flow, mgd
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Rainfall, inches
0
0.25
0.5
0.75
1
1.25
1.5
1.75
0:00
12:00
0:00
12:00
0:00
12:00
30-Dec
31-Dec
1-Jan
Date & Time
Rainfall
Model
PS S-8

APPENDIX I - RAINFALL ANALYSIS REPORT

October 7, 2004

From:
John (Jack) H. Humphrey, Ph.D., P.E.
Hydmet, Inc.
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P.O. Box 678
Palo Cedro, CA 96073
530-547-3403 (office and fax)
530-547-4743 (home)
Email: hydmetjack@aol.com

To:
Tony Akel
Carollo Engineers
7580 North Ingram Avenue, Suite 112
Fresno, CA 93711

Pleasanton/Dublin Design Storm Report

Introduction

Meteorologically and geographically consistent design storms were desired for sewer system design in the Pleasanton and Dublin area.

Methodology

A literature search was made for precipitation records and maps of the Livermore Valley area. Primary sources found were California Department of Water Resources Bulletin 190, California Data Exchange Center (CDEC), NOAA Atlas 2, USGS Annual Precipitation Map for California, and NCDC daily and hourly precipitation records. There were also available some short-term recent precipitation records for Pleasanton.

Results

24-Hour Precipitation

Regional precipitation maps showed a marked decrease in precipitation from the hills (Pleasanton Ridge) west of Pleasanton and Dublin east to Livermore due to rain shadow effects. Table 1 shows NOAA Atlas 2 values for Pleasanton and Dublin city centers taken directly from the Internet (WWW.NWS.NOAA.GOV/OHD/HDSC/NOAAATLAS2.HTM.) . There were no significant differences between Pleasanton and Dublin and the same design storm is recommended for both cities.

Table 1.
24-Hour NOAA Atlas 2

Location		***NOAA Atlas 2***			***Design Storms***	
		5-Year	20-Year		5-Year	20-Year
Pleasanton	37.70N 121.905W	3.50	5.00		3.02-4.04	3.88-5.15
Dublin	37.71N 121.90W	3.45	4.85		3.02-4.04	3.88-5.15

Time Distributions
An analysis was made of 24-hour precipitation records and 1-hour precipitation records for Pleasanton DWR Station #24. This station, which has records from 1970 to 2001, has the only long-term record representative of the region. This data, as shown in Table 2, shows that the 1-hour depth was 21% of the 24-hour depth. Mean annual precipitation maps were used to adjust the design storm from the gage location to locations further west. Mean annual precipitation for the gage was 18', at I-680 it was 22" and 0.5 miles west of I-680 it was 24". No significant differences were found between Dublin and Pleasanton. These relationships were used to derive power equations for depth versus duration, as shown in Table 3.

Table 2.
DWR Gage #34 (Old Arroyo Mocho Well Gage)
Latitude 37.687 N, Longitude 121.876 W

	1-hour	24-hour
5-Year Recurrence	.66	3.02
20-Year Recurrence	.82	3.88

Table 3.
Equations for 24-Hour Design Storm

Recurrence	***Equation***	***60-min***	***1440-min***
5-yr: 0.5 mi west of I-680	D=.123*t^.48	.88	4.04
5-yr: at I-680	D=.114*t^.48	.81	3.74
5-yr: 1.0 mi east of I-680	D=.092*t^.48	.66	3.02
20-yr 0.5 mi west of I-680	D=.146*t^.49	1.09	5.15
20-yr at I-680	D=.134*t^.49	1.00	4.73
20-yr 1.0 mi east of I-680	D=.110*t^.49	.82	3.88

Design Storm Distributions

Tables 3A-3F show recommended hourly distributions for the 24-hour design storms. These distributions are balanced, symmetrical distributions as used nationwide for design storms.

Table 3A Design Storm
Five-Year Recurrence 0.5 Miles West of Interstate 680

D=.123*t^.48

Hour	***Minute***	***Depth***	***Incremental***	***Design***
1	60	0.88	0.88	**0.08**
2	120	1.22	0.35	**0.09**
3	180	1.49	0.26	**0.09**
4	240	1.71	0.22	**0.10**
5	300	1.90	0.19	**0.10**
6	360	2.07	0.17	**0.11**
7	420	2.23	0.16	**0.12**
8	480	2.38	0.15	**0.14**
9	540	2.52	0.14	**0.16**
10	600	2.65	0.13	**0.19**
11	660	2.78	0.12	**0.26**
12	720	2.89	0.12	**0.88**
13	780	3.01	0.11	**0.35**
14	840	3.12	0.11	**0.22**
15	900	3.22	0.10	**0.17**
16	960	3.32	0.10	**0.15**
17	1020	3.42	0.10	**0.13**
18	1080	3.52	0.10	**0.12**
19	1140	3.61	0.09	**0.11**
20	1200	3.70	0.09	**0.10**
21	1260	3.79	0.09	**0.10**
22	1320	3.87	0.09	**0.09**
23	1380	3.95	0.08	**0.09**
24	1440	4.04	0.08	**0.08**

Table 3B

Five-Year Recurrence at Interstate 680

D=.114*t^.48

Hour	*Minute*	*Depth*	*Incremental*	*Design*
1	60	0.81	0.81	**0.08**
2	120	1.13	0.32	**0.08**
3	180	1.38	0.24	**0.09**
4	240	1.58	0.20	**0.09**
5	300	1.76	0.18	**0.10**
6	360	1.92	0.16	**0.11**
7	420	2.07	0.15	**0.12**
8	480	2.21	0.14	**0.13**
9	540	2.34	0.13	**0.15**
10	600	2.46	0.12	**0.18**
11	660	2.57	0.12	**0.24**
12	720	2.68	0.11	**0.81**
13	780	2.79	0.11	**0.32**
14	840	2.89	0.10	**0.20**
15	900	2.98	0.10	**0.16**
16	960	3.08	0.09	**0.14**
17	1020	3.17	0.09	**0.12**
18	1080	3.26	0.09	**0.11**
19	1140	3.34	0.09	**0.10**
20	1200	3.43	0.08	**0.09**
21	1260	3.51	0.08	**0.09**
22	1320	3.59	0.08	**0.08**
23	1380	3.66	0.08	**0.08**
24	1440	3.74	0.08	**0.08**

Table 3C
Five-Year Recurrence 1.0 Miles East of Interstate 680

D=.092*t^.48

Hour	***Minute***	***Depth***	***Incremental***	***Design***
1	60	0.66	0.66	**0.06**
2	120	0.92	0.26	**0.07**
3	180	1.11	0.20	**0.07**
4	240	1.28	0.16	**0.07**
5	300	1.42	0.14	**0.08**
6	360	1.55	0.13	**0.08**
7	420	1.67	0.12	**0.09**
8	480	1.78	0.11	**0.10**
9	540	1.89	0.10	**0.12**
10	600	1.98	0.10	**0.14**
11	660	2.08	0.09	**0.20**
12	720	2.16	0.09	**0.66**
13	780	2.25	0.08	**0.26**
14	840	2.33	0.08	**0.16**
15	900	2.41	0.08	**0.13**
16	960	2.48	0.08	**0.11**
17	1020	2.56	0.07	**0.10**
18	1080	2.63	0.07	**0.09**
19	1140	2.70	0.07	**0.08**
20	1200	2.77	0.07	**0.08**
21	1260	2.83	0.07	**0.07**
22	1320	2.90	0.06	**0.07**
23	1380	2.96	0.06	**0.06**
24	1440	3.02	0.06	**0.06**

20-Year Recurrence 0.5 Miles West of Interstate 680

D=.146*t^.49

Hour	Minute	Depth	Incremental	Design
1	60	1.09	1.09	**0.11**
2	120	1.52	0.44	**0.11**
3	180	1.86	0.34	**0.12**
4	240	2.14	0.28	**0.13**
5	300	2.39	0.25	**0.14**
6	360	2.61	0.22	**0.15**
7	420	2.82	0.20	**0.16**
8	480	3.01	0.19	**0.18**
9	540	3.19	0.18	**0.20**
10	600	3.35	0.17	**0.25**
11	660	3.52	0.16	**0.34**
12	720	3.67	0.15	**1.09**
13	780	3.81	0.15	**0.44**
14	840	3.96	0.14	**0.28**
15	900	4.09	0.14	**0.22**
16	960	4.22	0.13	**0.19**
17	1020	4.35	0.13	**0.17**
18	1080	4.47	0.12	**0.15**
19	1140	4.59	0.12	**0.14**
20	1200	4.71	0.12	**0.13**
21	1260	4.83	0.11	**0.12**
22	1320	4.94	0.11	**0.12**
23	1380	5.05	0.11	**0.11**
24	1440	5.15	0.11	**0.11**

Table 3E

20-Year Recurrence at Interstate 680

D=.134*t^.49

Hour	*Minute*	*Depth*	*Incremental*	*Design*
1	60	1.00	1.00	**0.10**
2	120	1.40	0.40	**0.10**
3	180	1.71	0.31	**0.11**
4	240	1.97	0.26	**0.12**
5	300	2.19	0.23	**0.12**
6	360	2.40	0.20	**0.13**
7	420	2.59	0.19	**0.15**
8	480	2.76	0.17	**0.16**
9	540	2.92	0.16	**0.19**
10	600	3.08	0.15	**0.23**
11	660	3.23	0.15	**0.31**
12	720	3.37	0.14	**1.00**
13	780	3.50	0.13	**0.40**
14	840	3.63	0.13	**0.26**
15	900	3.76	0.12	**0.20**
16	960	3.88	0.12	**0.17**
17	1020	3.99	0.12	**0.15**
18	1080	4.11	0.11	**0.14**
19	1140	4.22	0.11	**0.13**
20	1200	4.32	0.11	**0.12**
21	1260	4.43	0.10	**0.11**
22	1320	4.53	0.10	**0.11**
23	1380	4.63	0.10	**0.10**
24	1440	4.73	0.10	**0.10**

Table 3F

20-Year Recurrence 1.0 Mile East of Interstate 680

D=.110*t^.49

Hour	*Minute*	*Depth*	*Incremental*	*Design*
1	60	0.82	0.82	**0.08**
2	120	1.15	0.33	**0.09**
3	180	1.40	0.25	**0.09**
4	240	1.61	0.21	**0.10**
5	300	1.80	0.19	**0.10**
6	360	1.97	0.17	**0.11**
7	420	2.12	0.15	**0.12**
8	480	2.27	0.14	**0.13**
9	540	2.40	0.13	**0.15**
10	600	2.53	0.13	**0.19**
11	660	2.65	0.12	**0.25**
12	720	2.76	0.12	**0.82**
13	780	2.87	0.11	**0.33**
14	840	2.98	0.11	**0.21**
15	900	3.08	0.10	**0.17**
16	960	3.18	0.10	**0.14**
17	1020	3.28	0.10	**0.13**
18	1080	3.37	0.09	**0.12**
19	1140	3.46	0.09	**0.11**
20	1200	3.55	0.09	**0.10**
21	1260	3.64	0.09	**0.09**
22	1320	3.72	0.08	**0.09**
23	1380	3.80	0.08	**0.08**
24	1440	3.88	0.08	**0.08**

APPENDIX J - ADDITIONAL STUDIES

From: Jason Nikaido
To: Masjedi, Abbas
Date: 12/12/2006 2:51 PM
Subject: Staples Ranch
Attachments: Staples_Ranch_Profiles.pdf

Abbas -

Per your request the revised projected flow (250,000 gpd) from the Staples Ranch development was simulated under future flow conditions and the 5-Year, 24-Hour Design Storm. Based on the analysis completed, the additional flow does not appear to adversely impact the system. Figures 1 and 2 provide hydraulic profiles for the two reaches requested.

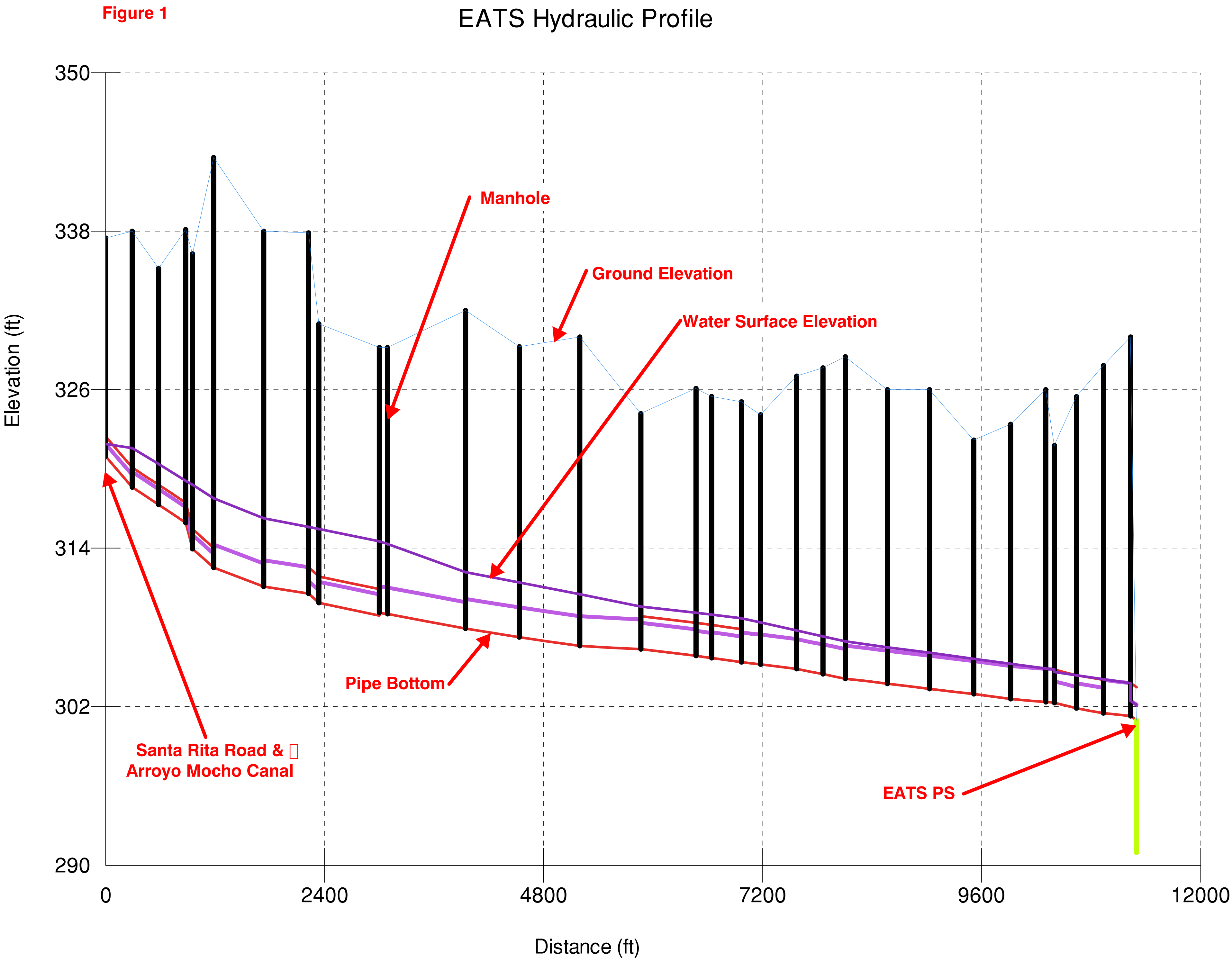
Figure 1: EATS pipeline - The pipeline is surcharged but does not violate the wet weather flow criteria of 1 foot below rim. Without the additional Staples Ranch flow, the pipeline would still be surcharged.

Figure 2: Staples Ranch to EATS pipeline - The peak wet weather flow is contained within the pipeline.

Please let me know if you have any questions.

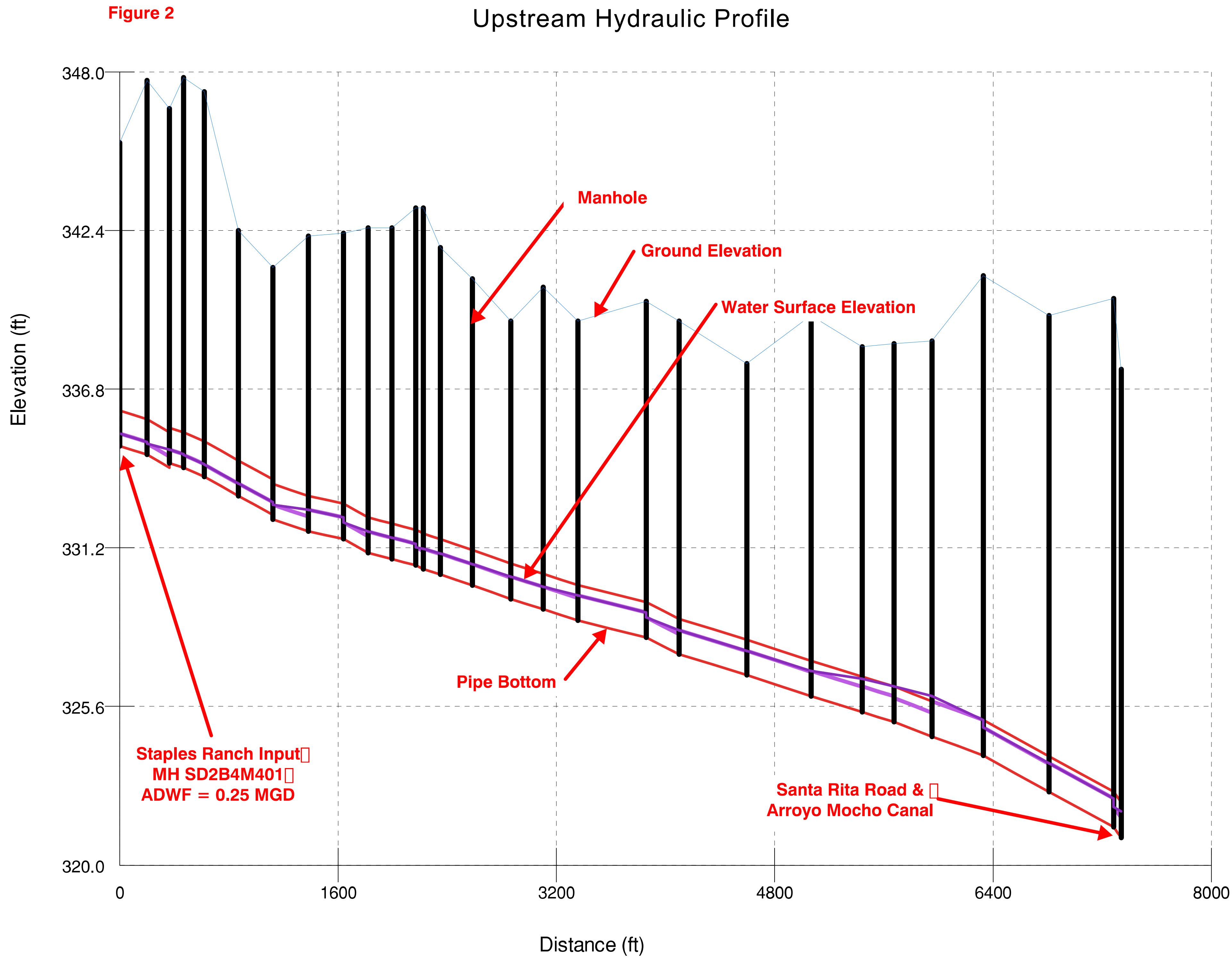
Jason Nikaido, P.E.
Carollo Engineers
2700 Ygnacio Valley Rd, Suite 300
Walnut Creek, CA 94598
Operator: (925) 932-1710 (Ext. 3138)
Direct: (925) 977-3138
Fax: (925) 930-0208

Figure 1



EATS Hydraulic Profile
350
338
326
314
302
290
Elevation (ft)
0
2400
4800
7200
9600
12000
Distance (ft)
Manhole
Ground Elevation
Water Surface Elevation
Pipe Bottom
Santa Rita Road &
Arroyo Mocho Canal
EATS PS

Figure 2



Upstream Hydraulic Profile
348.0
342.4
336.8
331.2
325.6
320.0
Elevation (ft)
0
1600
3200
4800
6400
8000
Distance (ft)
Manhole
Ground Elevation
Water Surface Elevation
Pipe Bottom
Staples Ranch Input
MH SD2B4M401
ADWF = 0.25 MGD
Santa Rita Road &
Arroyo Mocho Canal

December 27, 2005
6825A.00

City of Pleasanton
3333 Busch Road
P.O. Box 520
Pleasanton, California 94552

Attention: Mr. Steve Cusenza, Manager of Utilities

Subject: Stoneridge Mall Development and BART Analysis

Dear Mr. Cusenza:

This letter summarizes the results of the Stoneridge Mall Development and BART Analysis per teleconference on December 20, 2005. The City requested that Carollo determine the impact of additional mall development flows and a new BART station on the system.

BACKGROUND

New development is proposed in the Stoneridge Mall consisting of a new Nordstrom area, new retail in the existing Nordstrom area, and new restaurants. A new BART station north of the mall is also proposed. The following mall flows were added to the hydraulic model based on flows provided by City staff. All flows are average maximum day values and are fitted to the diurnal pattern for Basin 1. Currently, projected BART flows are unknown. Therefore, the maximum allowable BART flow was determined by increasing the flow until the wet weather surcharge criteria of 1 foot below ground was exceeded.

- New Nordstrom = 8,539 gpd @ MH SA2B1M500
- Redevelopment of existing Nordstrom = 11,000 gpd @ MH SA2B1M500
- New restaurants = 33,000 gpd @ MH SA2D1M300

In addition, pipe SA2B1P500201 (Reach “A”) was adjusted to reflect a proposed alignment that wraps around the new Nordstrom building. See Figure 1 for Analysis Layout.

ANALYSIS

The following scenarios were simulated in the hydraulic model to determine the impact of additional flows on the system.

- Scenario 1: Adjust mall diversion
- Scenario 2: New south mall pipe connection (Reach “B”).
- Scenario 3: New Nordstrom pipe alignment (Reach “C”).
- Scenario 4: Alterative BART connection point.

2700 YGNACIO VALLEY ROAD, SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • (925) 932-1710 • FAX (925) 930-0208

Under DWF conditions, the new developments do not cause any deficiencies based on the Master Plan criterion of d/D = 0.75 for DWF. Under wet weather conditions, the goal was to prevent the HGL from exceeding the Master Plan surcharge criterion of HGL 1 foot below ground. This criterion was exceeded only in Scenario 1. In the Master Plan's CIP, the mall diversion, MH SA2A2M412, was recommended for improvement to a flow split of 60 percent to the east and 40 percent to the south was recommended. Scenario 1 recommends a flow split of 65 percent to the east and 35 percent to the south. The HGL criterion is not violated downstream in the 10, 15, 18, and 24-inch pipes.

The following table presents a summary of the modeling effort. Model assumptions, maximum BART flow, and new pipe length are included. Based on the modeling effort, Scenario 2 is recommended. Although potentially more expensive, a new south mall pipe connection will benefit both the mall and BART developments. Scenario 2 also accommodates the greatest BART flow and is a very reliable solution.

SUMMARY

The following is a summary of the analysis.

- 52,540 gpd max day DWF added to model from mall development.
- During DWF conditions pipes flow below d/D < 0.75.
- New south mall connection (Scenario 2, Reach "B") provides the greatest relief to system.

If you have any questions regarding this letter, please feel free to contact us.

Sincerely,

CAROLLO ENGINEERS, P.C.

Jason Nikaido
Project Engineer

JN:dlt

cc: Mr. Abbas Masjedi, Utility Engineer
Tony Akel, Carollo Engineers

MODELING SUMMARY STONERIDGE MALL DEVELOPMENT AND BART ANALYSIS CITY OF PLEASANTON					
Scenario	**Description**	**Mall Diversion (%East/ %West)**	**BART Input MH**	**Pipe Length (Feet)**	**Max BART Flow (gpd)**
1	Adjust Mall Diversion(1)	65/35	SA2B1M302	0	65,000
2	New south mall pipeline connection - Reach "B" (MH SA2A4M103 to MH SA2A4M500)	60/40(2)	SA2B1M302	850	220,000(3)
3	New Nordstrom pipeline alignment - Reach "C" (MH SAB1M500 to MH SA2B3M202)	60/40	SA2B1M302	860	120,000(4)
4	BART to MH SA2B1M200	60/40	SA2B1M200	0(5)	100,000(6)

Notes:

(1) Approximately 1 mgd PWWF from Dublin Canyon.
(2) Master Plan CIP recommendation.
(3) Approximately 0.24 mgd PWWF diverted to south mall pipe.
(4) New Nordstrom pipe alignment makes pipe steeper and allows more flow.
(5) Excludes on-site BART pipes.
(6) More BART flow possible. Downstream 10-inch pipe section is bottleneck.

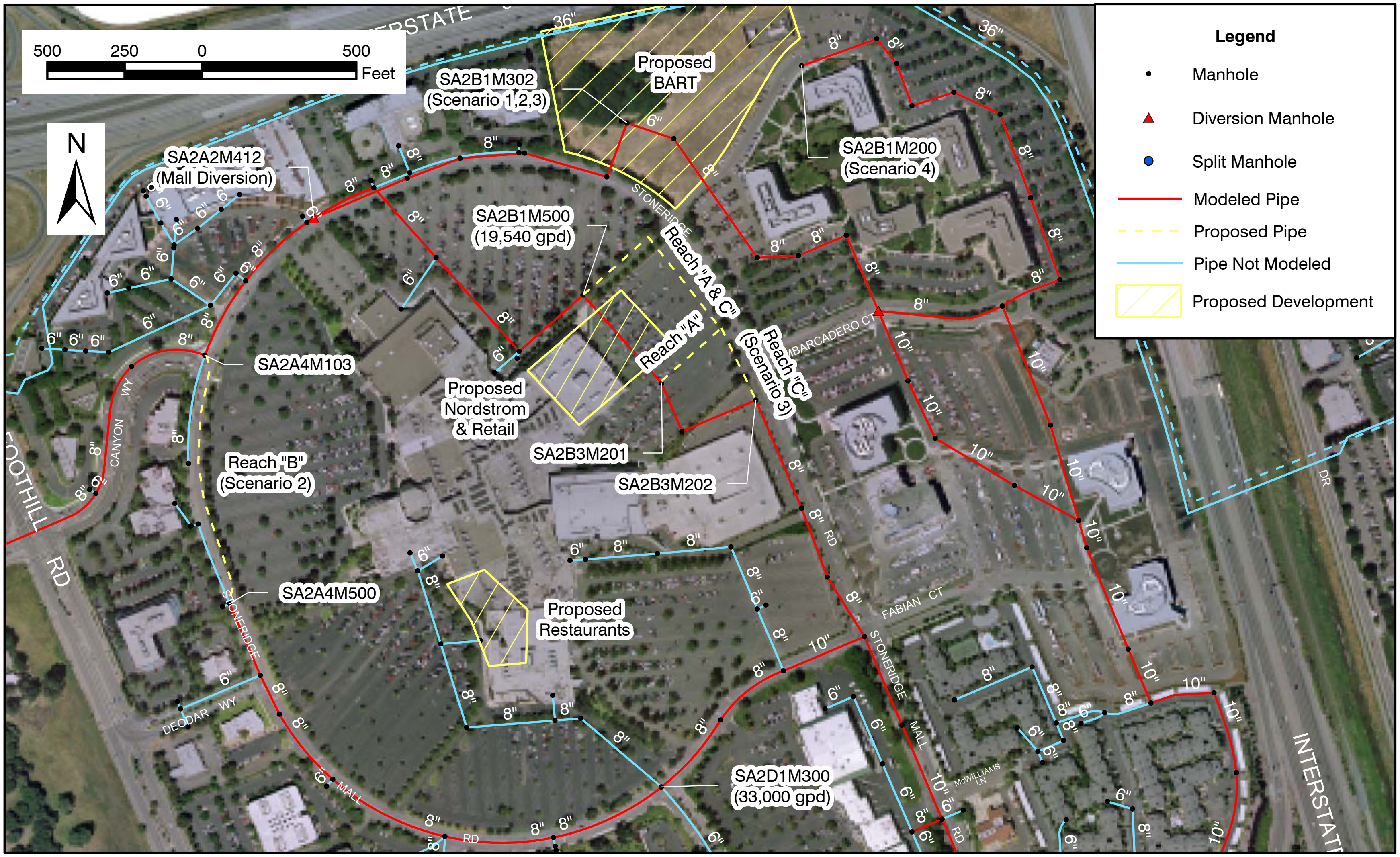


Figure 1
ANALYSIS LAYOUT
STONERIDGE MALL AND BART DEVELOPMENT ANALYSIS
CITY OF PLEASANTON

H:\Client\Pleasanton_WCO\6825A00\Stoneridge_mall\scenarios.mxd
December 27, 2005

APPENDIX K - SEWER SYSTEM MANAGEMENT PLAN INTERNAL AUDIT WORKSHEETS

Sewer System Management Plan (SSMP)

INITIAL AUDIT WORKSHEETS

City of Pleasanton

March 2005

General Information

CHECKLIST COMPLETED BY:

Abbas Masjedi
Name

Date March 24, 2005

925 931.5508
Daytime Telephone Number

UTILITY CONTACT INFORMATION

Utility Name City of Pleasanton

LOCATION

3333 Busch Road
Street Address

P.O. Box 520
Street Address (continued)

Pleasanton, CA 94552
City State Zip

STAFF

Abbas Masjedi
Name

Utility Engineer
Title

amasjedi@ci.pleasanton.ca.us
Email

Phone (925) 931.5508 Fax (925) 931.5595

PERMITTED TREATMENT & COLLECTION FACILIITES

NPDES or STATE PERMIT #	PERMITTEE/CO-PERMITTEE/JURISDICTIONS	PERMIT COVERAGE WWTP Effluent	Collection System	Wet-Weather Facility
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐
		☐	☐	☐

Collection System Description

SYSTEM INVENTORY

Treatment Facilities		
# of Treatment facilities	0	NUMBER
WWTP design capacity	8.5	MGD
Average daily flow	6.5	MGD
Average dry weather flow	6.1	MGD

Access & Maintenance		
Manholes	5,283	NUMBER
Number of air vacuum relief valves	0	NUMBER

Conveyance & Pumping

	Gravity Sewers	Force Mains	Pump Stations
Pipes and pumps Length/quantity	240 MILES	4.7 MILES	12 NUMBER
Age of system 0 - 25 years old	60.3 % PERCENT	1.63 % PERCENT	16.6 % NUMBER
26 - 50 years old	36.5 % PERCENT	.29 % PERCENT	66.8 % NUMBER
51 - 75 years old	.29 % PERCENT	0 % PERCENT	% NUMBER
>76 years old	0 % PERCENT	0 % PERCENT	% NUMBER

Number of inverted siphons 4

SERVICE AREA CHARACTERISTICS

Service area	15,303.48	ACRES
Service population	67,000	PEOPLE
Annual precipitation	18	INCHES

Number of Service Connections

Residential		Commercial		Industrial		TOTAL
25,546 NUMBER	+	786 NUMBER	+	4 NUMBER	=	26,336 NUMBER

Collection system service lateral responsibility *(check one)*

- ☑ At main line connection only
- ☐ From main line to property line or easement/cleanout
- ☐ Beyond property line/clean out
- ☐ Other: ______________

Combined Sewer Systems

What percent of sewer system is served by combined sewers (i.e., sanitary sewage and storm water in the same pipe)? 0 % PERCENT

Collection System Description

PIPE DIAMETER

	Gravity Sewers	Force Mains
8 inches or less	78 %	.76 %
9 - 18 inches	15 %	1.12 %
19 - 36 inches	4.4 %	%
>36 inches	0 %	0 %

PIPE MATERIALS

	Gravity Sewers	Force Mains
Prestressed concrete cylinder pipe (PCCP)	%	%
High density polyethylene (HDPE)	.003 %	.84 %
Reinforced concrete pipe (RCP)	1.34 %	.02 %
Polyvinyl chloride (PVC)	25.8 %	.32%
Vitrified clay pipe (VCP)	67.6 %	.41%
Ductile iron	.74 %	.35 %
Non-reinforced concrete pipe	%	%
Asbestos cement pipe	1.63 %	%
Cast iron	.11 %	%
Brick	%	%
Fiberglass	%	%
Other (*Explain*) Steel	.006 %	%

Engineering Design (ED)

ED-01	Is there a document which includes design criteria and standard construction details?	YES	NO
ED-02	Is there a document that describes the procedures that the utility follows in construction design review?	YES	NO
ED-03	Are WWTP and O&M staff involved in the design review process?	YES	NO
ED-04	Is there a procedure for testing and inspecting new or rehabilitated system elements both during and after the construction is completed?	YES	NO
ED-05	Are construction sites supervised by qualified personnel (such as professional engineers or certified engineering technicians) to ascertain that the construction is taking place in accordance with the agreed upon plans and specifications?	YES	NO
ED-06	Are new manholes tested for inflow and infiltration?	YES	NO
ED-07	Are new gravity sewers checked using closed circuit TV inspection?	YES	NO
ED-08	Does the utility have documentation on private service lateral design and inspection standards? But, not approved by Public Works Director.	YES	NO
ED-09	Does the utility attempt to standardize equipment and sewer system components?	YES	NO

Satellite Communities and Sewer Use Ordinance (SUO)

SUO-01	Does the utility receive flow from satellite communities? IF NO, GO TO PAGE 6 Castlewood, CSA	**YES** (circled)	NO
SUO-02	What is the total area from satellite communities that contribute flow to the collection system? *(Acres or square miles)*	.69 sq mi	
SUO-03	Does the utility require satellite communities to enter into an agreement? IF NO, GO TO QUESTION SUO-06.	**YES** (circled)	NO
SUO-04	Does the agreement include the requirements listed in the sewer use ordinance (SUO)?	**YES** (circled)	NO
SUO-05	Do the agreements have a date of termination and allow for renewal under different terms?	**YES** (circled)	NO
SUO-06	Does the utility maintain the legal authority to control the maximum flow introduced into the collection system from satellite communities?	**YES** (circled)	NO
SUO-07	Are standards, inspections, and approval for new connections clearly documented in a SUO?	**YES** (circled)	NO
SUO-08	Does the SUO require satellite communities to adopt the same industrial and commercial regulator discharge limits as the utility?	**YES** (circled)	NO
SUO-09	Does the SUO require satellite communities to adopt the same inspection and sampling schedules as required by the pretreatment ordinance?	**YES** (circled)	NO
SUO-10	Does the SUO require that satellite communities or the utility to issue control permits for significant industrial users?	**YES** (circled)	NO
SUO-11	Does the SUO contain provisions for addressing overstrength wastewater from satellite communities?	**YES** (circled)	NO

SUO-12 Does the SUO contain procedures for the following? *(Check all that apply)*

- [x] Inspection standards
- [x] Pretreatment requirements
- [x] Building/sewer permit issues

SUO-13 Does the SUO contain general prohibitions of the following materials? *(Check all that apply)*

- [x] Fire and explosions hazards
- [x] Corrosive materials
- [x] Obstructive materials
- [x] Oils or petroleum
- [x] Material which may cause interference at the wastewater treatment plant

SUO-14 Does the SUO contain procedures and enforcement actions for the following? *(Check all that apply)*

- [x] Fats, oils, and grease (FOG)
- [x] Storm water connections to sanitary lines (downspouts)
- [ ] Infiltration and inflow
- [ ] Defects in service laterals located on private property
- [ ] Building structures over the sewer lines
- [ ] Sump pumps, air conditioner connections

Organizational Structure (OC)

OC-01 Is an organizational chart available that shows the overall personnel structure for the utility, including operation and maintenance staff? YES NO

OC- 02 Are up-to-date job descriptions available that delineate responsibilities and authority for each position? YES NO

OC-03 Are the following items discussed in the job descriptions? *(Check all that apply)*

- [x] Nature of work to be performed
- [x] Examples of the types of work
- [x] Minimum requirements for the position
- [x] List of licenses required for the position
- [x] Necessary special qualifications or certifications
- [ ] Performance measures or promotion potential

OC-04 What percent of staff positions are currently vacant? 5 %

OC-05 On average how long do positions remain vacant? *(months)* 5

OC-06 What percent of utility work is contracted out? 5 %

Internal Communications (IC)

IC-01 Which of the following methods are used to communicate with utility staff? *(Check all that apply)*

☑ Regular meetings ☑ Bulletin boards ☑ E-mail ☑ Other (walkie talkie/pager)

IC-02 How often are staff meetings held? *(e.g., Daily, Weekly, Monthly, etc.)* Weekly

IC-03 Are incentives offered to employees for performance improvements? YES NO

IC-04 Does the utility have an "Employee of the Month/Quarter/Year" program? YES NO

IC-05 How often are performance reviews conducted? *(e.g. Semi-annually, Annually, etc.)* Semi-Annual

IC-06 Does the utility regularly communicate/coordinate with other municipal departments? YES NO

Budgeting (BUD)

BUD-01 What is the average annual fee for residential users? $ 372

BUD-02 How often are user charges evaluated and adjusted? *(e.g. annually, biannually, etc.)* Annually

BUD-03 Are utility-generated funds used for non-utility programs? YES NO

BUD-04 Are costs for collection system operation and maintenance (O&M) separated from other utility services such as water, storm water, and treatment plants? IF NO, GO TO QUESTION BUD-07. YES NO

BUD-05 What is your average annual (O&M) budget? $ 2 million

BUD-06 What percentage of the utility's overall budget is allocated to maintenance of the collection system? 35 %

BUD-07 Does the utility have a Capital Improvement Plan (CIP) that provides for system repairs/replacements on a prioritized basis? YES NO

BUD-08 What is your average annual CIP budget? Five-Year CIP Average Expenditure $ 1,515,000

BUD-09 What percentage of the maintenance budget is allotted to the following maintenance?

Predictive maintenance
(tracking design, life span, and scheduled parts replacements) 25 %

Preventive maintenance
(identifying and fixing system weaknesses which, if left unaddressed, could lead to overflows) 50 %

Corrective maintenance
(fixing system components that are functioning but not at 100% capacity/efficiency; for example partially blocked lines) 20 %

Emergency maintenance
(reactive maintenance, overflows, equipment breakdowns) 5 %

BUD-10 Does the utility receive sufficient funding from its revenue?
BUD-11 Does the operation budget provide for sufficient funding to the O&M program? YES NO

BUD-12 Does the utility maintain a fund for future equipment and infrastructure replacement? YES NO

Training (TR)

TR-01 Does the utility have a formal job knowledge, skills, and abilities (KSA) training program? YES (circled) NO

TR-02 Does the training program address the fundamental mission, goals, and policies of the utility? YES (circled) NO

TR-03 Does the utility have mandatory training requirements identified for key employees? YES (circled) NO

TR-04 What percentage of employees met or exceeded their annual training goals during the past year? 60 %

TR-05 Does the utility provide training in the following areas? *(Check all that apply)*

- [x] Safety
- [x] Traffic control
- [x] Public relations
- [x] Routine line maintenance
- [x] Record keeping
- [x] SSO/Emergency response
- [x] Confined space entry
- [x] Electrical and instrumentation
- [x] Pump station operations and maintenance
- [x] Other
- [x] Pipe repair
- [x] CCTV and trench/shoring
- [ ] Bursting CIPP

TR-06 Are operator and maintenance certification programs used? IF NO, GO TO QUESTION TR-08 YES (circled) NO

TR-07 Are operator and maintenance certification programs required? YES (circled) NO

TR-08 Is on-the-job training progress and performance measured? YES (circled) NO

TR-09 Which of the following methods are used to assess the effectiveness of the training? *(Check all that apply)*

- [ ] None
- [x] Periodic testing
- [x] Drills
- [x] Demonstrations

TR-10 What percentage of the training offered by the utility is in the form of the following?

Manufacturer training 15 %

In-house classroom training 25 %

On-the-job training 25 %

Industry-wide training %

Safety (SAF)

SAF-01 Does the utility have a written safety policy? YES NO

SAF-02 How often are safety procedures reviewed and revised? *(e.g. Semiannually, Annually, etc.)* YES NO

SAF-03 Does the utility have a safety committee, and how often do they meet? YES NO

SAF-04 Are regular safety meetings held with the utility employees? YES NO

SAF-05 Does the utility have a safety training program? YES NO

SAF-06 Are records of employee safety training kept up to date? YES NO

SAF-07 Does the utility have written procedures for the following? *(Check all that apply)*

- [x] Lockout/tagout
- [x] Material safety date sheets (MSDS)
- [x] Chemical handling
- [x] Confined spaces permit program
- [x] Trenching and excavations safety
- [ ] Biological hazards in wastewater
- [ ] Traffic control and work site safety
- [ ] Electrical and mechanical systems
- [ ] Pneumatic and hydraulic systems safety

SAF-08 What is your agency's lost-time injury rate? ________ % or Unknown hours

SAF-09 Are the following equipment items available and in adequate supply? *(Check all that apply)*

- [x] Rubber/disposable gloves
- [x] Confined space ventilation equipment
- [x] Hard hats, safety glasses, rubber boots
- [x] Antibacterial soap and first aid kit
- [x] Tripods or non-entry rescue equipment
- [x] Fire extinguishers
- [x] Equipment to enter manholes
- [x] Portable crane/hoist
- [x] Atmospheric testing equipment and gas detectors
- [x] Oxygen sensors
- [x] H_2S Monitors
- [x] Full body harness
- [x] Protective clothing
- [x] Traffic/public access control equipment
- [ ] 5-minute escape breathing devices
- [ ] Life preservers for lagoons
- [ ] Safety buoy at activated sludge plants
- [x] Fiberglass or wooden ladders for electrical work
- [x] Respirators and/or self contained breathing apparatus
- [x] Methane gas or optical vector (OVA) analyzer
- [x] Lower explosion limit (LEL) metering

SAF-10 Are safety monitors clearly identified? YES NO

Customer Service (CS)

CS-01 Does the utility have a customer service and public relations program? IF NO GO TO QUESTION CS-03 — YES (circled) / NO

CS-02 Does the customer service program include giving formal presentations on the wastewater field to the following? *(Check all that apply)*

- [x] Schools and universities
- [ ] Local officials
- [x] Media
- [ ] Building Inspector(s)
- [x] Community gatherings
- [x] Businesses
- [x] Citizens
- [x] Public utility officials

CS-03 Are employees of the utility specifically trained in customer service? — YES (circled) / NO

CS-04 Are there sample correspondence, Q/A's, or "scripts" to help guide staff through written or oral responses to customers? — YES / NO (circled)

CS-05 What methods are used to notify the public of major construction or maintenance work? *(Check all that apply)*

- [x] Door hangers
- [x] Newspaper
- [x] Fliers
- [x] Signs
- [ ] Other
- [ ] None
- [x] Public radio or T.V. announcements

CS-06 Is a homeowner notified prior to construction that his/her property may be affected? — YES (circled) / NO

CS-07 Do you provide information to residents on cleanup and safety procedures following basement backups and overflows from manholes when they occur? — YES / NO (circled)

CS-08 Does the utility have a customer service evaluation program to obtain feedback from the community? — YES (circled) / NO

CS-09 Do customer service records include the following information? *(Check all that apply)*

- [x] Personnel who received the complaint or request
- [x] Name, address, and telephone number of customer
- [x] Nature of the complaint or request
- [x] Location of the problem
- [x] To whom the follow-up action was assigned
- [x] Date the follow up action was assigned
- [x] Date of the complaint or request
- [x] Cause of the problem
- [x] Date the complaint or request was resolved
- [ ] Feedback to customer
- [x] Total days to end the problem

CS-10 Does the utility have a goal for how quickly customer complaints (or ermergency calls) are resolved? IF NO, GO TO THE NEXT PAGE. — YES (circled) / NO

CS-11 What percentage of customer complaints (or emergency calls) are resolved within the timeline goals? 95 %

Equipment and Collection System Maintenance (ESM)

ESM-01 Is a maintenance card or record kept for each piece of mechanical equipment within the collection system? IF NO, GO TO QUESTION ESM-03. YES **NO**

ESM-02 Do equipment maintenance records include the following information? *(Check all that apply)*

- [x] Maintenance recommendations
- [x] Maintenance schedule
- [x] Instructions on conducting the specific maintenance activity
- [x] A record of maintenance on the equipment to date
- [x] Other observations on the equipment

ESM-03 Are dated tags used to show out-of-service equipment? **YES** NO

ESM-04 Is there an established system for prioritizing equipment maintenance needs? **YES** NO

ESM-05 What percent of repair funds are spent on emergency repairs? 15 %

ESM-06 Are corrective repair work orders backlogged more than six months? YES **NO**

ESM-07 Do collection system personnel coordinate with state, county, and local personnel on repairs, before the street is paved? **YES** NO

Equipment Parts Inventory (EPI)

EPI-01	Have critical spare parts been identified?	YES	NO
EPI-02	Are adequate supplies on hand to allow for two point repairs in any part of the system?	YES	NO
EPI-03	Is there a parts standardization policy in place?	YES	NO
EPI-04	Does the utility have a central location for storing spare parts?	YES	NO
EPI-05	Does the utility maintain a stock of spare parts on its maintenance vehicles?	YES	NO
EPI-06	Does the utility have a system in place to track and maintain an accurate inventory of spare parts?	YES	NO
EPI-07	For those parts which are not kept in inventory, does the utility have a readily available source or supplier?	YES	NO

Management Information System (MIS)

MIS-01	Does the utility have a management information system (MIS) in place for tracking maintenance activities? *(Either electronic or good paper files)* IF NO, GO TO PAGE 15.	YES ☑	NO ☐
MIS-02	Are the MIS records maintained for a period of at least three years?	YES ☑	NO ☐
MIS-03	Is the MIS able to distinguish activities taken in response to an overflow event?	YES ☑	NO ☐

MIS-04 Are there written instructions for managing and tracking the following information? *(Check all that apply)*

- ☑ Complaint work orders
- ☑ Scheduled inspections
- ☑ Compliance/overflow tracking
- ☑ Scheduled work orders
- ☐ Sewer system inventory
- ☐ Equipment/tools tracking
- ☑ Customer service
- ☑ Safety incidents
- ☐ Parts inventory
- ☑ Scheduled preventive maintenance
- ☑ Scheduled monitoring/ sampling

MIS-05 Do the written instructions for tracking procedures include the following information? *(Check all that apply)*

- ☑ Accessing data and information
- ☑ Updating the MIS
- ☑ Instructions for using the tracking system
- ☑ Developing and printing reports

MIS-06 How often is the management information system updated? *(Check one)*

- ☑ Immediately
- ☐ Within one week of the "incident"
- ☐ Monthly
- ☐ As time permits

System Mapping (MAP)

MAP-01 Are "as built" plans (record drawings) or maps available for use by field crews in the office and in the field? YES NO

MAP-02 Is there a procedure for field crews to record changes or inaccuracies in the maps and update the mapping system? YES NO

MAP-03 Do the maps show the date the map was drafted and the date of the last revision? YES NO

MAP-04 Do the sewer line maps include the following? *(Check all that apply)*

- [x] Scale
- [x] North arrow
- [x] Date the map was drafted
- [x] Date of last revision
- [x] Service area boundaries
- [x] Property lines
- [x] Other landmarks (Roads, water bodies, etc.)
- [x] Manhole and other access points
- [x] Location of building laterals
- [x] Street names
- [x] SSOs occurrences/CSOs outfalls
- [x] Flow monitors
- [x] Force mains
- [x] Pump stations
- [x] Lined sewers
- [x] Main, trunk, and interceptor sewers
- [x] Easement lines and dimensions
- [x] Pipe material
- [x] Pipe diameter
- [x] Installation date
- [x] Slope
- [x] Manhole rim elevation
- [x] Manhole coordinates
- [x] Manhole invert elevation
- [x] Distance between manholes

MAP-05 Are the following sewer attributes recorded? *(Check all that apply)*

- [x] Size
- [x] Shape
- [x] Invert elevation
- [x] Material
- [ ] Separate/combined sewer
- [x] Installation Date

MAP-06 Are the following manhole attributes recorded? *(Check all that apply)*

- [ ] Shape
- [ ] Type (e.g., precast, cast in place, etc.)
- [x] Depth
- [x] Age
- [x] Material

MAP-07 Is there a systematic numbering and identification method/system established to identify sewer system manhole, sewer lines, and other items (pump stations, etc.)? YES NO

Internal TV Inspection (TVI)

TVI-01 Does the utility have a standardized pipeline condition assessment program? YES (circled) NO

TVI-02 Is internal TV inspection used to perform condition assessment? IF NO, GO TO PAGE 17. YES (circled) NO

TVI-03 Are there written operation procedures and guidelines for the internal TV inspection program? YES (circled) NO

TVI-04 Do the internal TV record logs include the following? *(Check all that apply)*

- [x] Pipe size, type, length, and joint spacing
- [x] Distance recorded by internal TV
- [x] Results of the internal TV inspection (including a structural rating)
- [x] Internal TV operator name
- [x] Cleanliness of the line
- [x] Location and identification of line being tele-vised by manholes

TVI-05 Is a rating system used to determine the severity of the defects found during the inspection process? YES (circled) NO

TVI-06 Is there documentation explaining the codes used for internal TV results reporting? YES (circled) NO

TVI-07 Approximately what percent of the total defects determined by TV inspection during the past 5 years were the following?

Failed coatings or linings	1 %	Line deflection	1 %
House connection leaks	1 %	Joint separation	10 %
Illegal connections	1 %	Crushed pipes	1 %
Pipe corrosion (H_2S)	5 %	Collapsed pipes	1 %
Fats, oil, and grease	20 %	Offset joints	20 %
Broken pipes	5 %	Root intrusions	20 %
Debris	1 %	Minor cracks	5 %
Other	10 %		

TVI-08 Are main line and lateral repairs checked by internal TV inspection after the repair(s) have been made? YES (circled) NO

Sewer Cleaning (CLN)

CLN-01	What is the system cleaning frequency? (the entire system is cleaned every <u>"X"</u> years)	2.0
CLN-02	What is the utility's plan for system cleaning (% or frequency in years)?	5
CLN-03	What percent of the sewer lines are cleaned, even high/repeat cleaning trouble spots, during the past year?	25 %
CLN-04	Is there a program to identify sewer line segments, with chronic problems, that should be cleaned on a more frequent schedule?	YES (circled) NO
CLN-05	Does the utility have a root control program?	YES NO (circled)
CLN-06	Does the utility have a fats, oils, and grease (FOG) program?	YES NO (circled)
CLN-07	What is the average number of stoppages experienced per mile of sewer pipe per year?	0.02/mi/yr %
CLN-08	Has the number of stoppages increased, decreased, or stayed the same over the past 5 years? ☐ Increased ☐ Decreased ☐ Stayed the same	
CLN-09	Are stoppages plotted on maps and correlated with other data such as pipe size and material or location?	YES (circled) NO
CLN-10	Do the sewer cleaning records include the following information? *(Check all that apply)* ☑ Date and time ☑ Method of cleaning ☑ Identity of cleaning crew ☐ Cause of stoppage ☐ Location of stoppage or routine cleaning activity ☑ Further actions necessary/initiated	
CLN-11	If sewer cleaning is done by a contractor are videos taken of before and after cleaning?	YES (circled) NO

Manhole Inspection and Assessment (MAN)

MAN-01 Does the utility have a routine manhole inspection and assessment program? IF NO, GO TO QUESTION MAN-06. YES NO

MAN-02 Are the results and observations from the routine manhole inspections recorded? YES NO

MAN-03 Does the utility have a goal for the number of manholes inspected annually? YES NO

MAN-04 How many manholes were inspected during the past year? ________

MAN-05 Do the records for manhole/pipe inspection include the following? *(Check all that apply)*

- ☐ Conditions of the frame and cover
- ☐ Evidence of surcharge
- ☐ Offsets or misalignments
- ☐ Atmospheric hazards measurements (especially hydrogen sulfide)
- ☐ Details on the root cause of cracks or breaks in the manhole or pipe including blockages
- ☐ Recording conditions of (corbel, walls, bench, trough, and pipe seals)
- ☐ Presence of corrosion
- ☐ If repair is necessary
- ☐ Manhole identifying number/location
- ☐ Wastewater flow characteristics (flowing freely or backed up)
- ☐ Accumulations of grease, debris, or grit
- ☐ Presence of infiltration, location, and estimated quantity
- ☐ Inflow from manhole covers

MAN-06 Does the utility have a grouting program? YES NO

Pump Stations (PS)

PS-01	Are Standard Operation Procedures (SOPs) and Standard Maintenance Procedures (SMPs) used for each pump station?	YES	NO
PS-02	Are there enough trained personnel to properly maintain all pump stations?	YES	NO
PS-03	Is there an emergency operating procedure for each pump station?	YES	NO
PS-04	Is there an alarm system to notify personnel of pump station failures and overflow?	YES	NO
PS-05	Percent of pump stations with back up power sources	100 %	
PS-06	Does the utility use the following methods when loss of power ocurs? *(Check all that apply)* ☑ On-site electrical generators ☑ Portable electric generators ☐ Alternate power source ☐ Other ☐ Vacuum trucks to bypass pump station		
PS-07	Is there a procedure for manipulating pump operations (manually or automatically) during wet weather to increase in-line storage of wet weather flows?	YES	NO
PS-08	Are wet well operating levels set to limit pump start/stops?	YES	NO
PS-09	Are the lead, lag, and backup pumps rotated regularly?	YES	NO
PS-10	Are operation logs maintained for all pump stations?	YES	NO
PS-11	Are the original manuals that contain the manufacturers recommended maintenance schedules for all pump station equipment easily available?	YES	NO
PS-12	On average, how often were pump stations inspected during the past year? 2x/week	YES	NO
PS-13	Are records maintained for each inspection?	YES	NO
PS-14	Average annual labor hours spent on pump station inspection	100/stn	
PS-15	Percent of pump stations with pump capacity redundancy	100 %	
PS-16	Percent of pump stations with dry weather capacity limitations	0 %	
PS-17	Percent of pump stations with wet weather capacity limitations	0 %	
PS-18	Percent of pump stations calibrated annually	100 %	
PS-19	Percent of pump stations with permanent flow meters	70 %	

Capacity Assessment (CA)

CA-01	Does the utility have a flow monitoring program?	YES **NO**
CA-02	Does the utility have a comprenhensive capacity assessment and planning program?	**YES** NO
CA-03	Are flows measured prior to allowing new connections?	YES **NO**
CA-04	Do you have a tool (hydraulic model, spreadsheet, etc.) for assessing whether adequate capacity exists in the sewer system? IF NO, GO TO QUESTION CA-06.	**YES** NO
CA-05	Does your capacity assessment tool produce results consistent with conditions observed in the system?	**YES** NO
CA-06	What is the ratio of peak wet weather flow to average dry weather flow at the wastewater treatment plant?	2.0
CA-07	How many permanent flow meters are currently in the system? *(Include meters at pump stations and wastewater treatment plants)*	5
CA-08	How frequently are the flow meters checked? *(e.g. Daily, Weekly, Monthly, etc.)*	weekly

CA-09 Do the flow meter checks include the following? *(Check all that apply)*

- [x] Independent water level
- [ ] Velocity reading
- [ ] Downloading data
- [ ] Checking the desiccant
- [x] Cleaning away debris
- [x] Battery condition

CA-10	Are records maintained for each inspection? IF NO, GO TO QUESTION CA-12.	**YES** NO

CA-11 Do the flow monitoring records include the following? *(Check all that apply)*

- [ ] Descriptive location of flow meter
- [ ] Frequency of flow meter inspection
- [x] Type of flow meter
- [x] Frequency of flow meter calibration

CA-12	Does the utility maintain any rain gauges or have access to local rainfall data?	**YES** NO
CA-13	Does the utility have any wet weather capacity problems?	**YES** NO
CA-14	Are low points or flood-plain areas monitored during rain events?	YES **NO**
CA-15	Does the utility have any dry weather capacity problems?	**YES** NO
CA-16	Is flow monitoring used for billing purposes, capacity analysis, and/or inflow and infiltration investigations?	**YES** NO

Tracking SSOs (TRK)

TRK-01	How many SSO events have been reported in the past 5 years?	25
TRK-02	What percent of the SSOs were less than 1,000 gallons in the past 5 years ?	75 %

TRK-03 Does the utility document and report all SSOs regardless of size? YES (circled) NO

TRK-04 Does the utility document basement backups? YES (circled) NO

TRK-05 Are there areas that experience frequent basement or street flooding? YES NO (circled)

TRK-06 Approximately what percent of SSOs discharges were from each of the following in the last 5 years?

Manholes 0 %

Main and trunk sewers 75 %

Structural bypasses 0 %

Pump stations 0 %

Lateral and branch sewers 25 %

TRK-07 Approximately what percent of SSOs discharges were caused by the following in the last 5 years?

Debris buildup 30 %

Root intrusion 25 %

Excessive infiltration and inflow 0 %

Collapsed pipe 0 %

Capacity limitations 5 %

Fats, oil, and grease 40 %

Vandalism 0 %

TRK-07A What percentage of SSOs were released to:

Soil 10 %

Basements 0 %

Paved area 70 %

Surface water (rivers/lakes/streams) 20 %

Coastal, ocean, beaches 0 %

TRK-07B For surface water releases, what percent are to areas that could affect:

Contact recreation (beaches, swimming, areas) 0 %

Drinking water sources 0 %

Shellfish growing areas 0 %

TRK-08	How many chronic SSO locations are in the collection system?	0

TRK-09 Are pipes with chronic SSOs being monitored for sufficient capacity and/or structural condition? YES (circled) NO

TRK-10 Prior to collapse, are structurally deteriorating pipelines being monitored for renewal or replacement? YES (circled) NO

Overflow Emergency Response Plan (OERP)

OERP-01	Does the utility have a documented OERP available for utility staff to use? IF NO, GO TO QUESTION OERP-04.	YES	NO
OERP-02	How often is the OERP reviewed and updated? *(Annually, Biannually, etc.)*	Annually	
OERP-03	Are specific responsibilities detailed in the OERP for personnel who respond to emergencies?	YES	NO
OERP-04	Are staff continuously trained and drilled to respond to emergency situations?	YES	NO
OERP-05	Do work crews have immediate access to tools and equipment during emergencies?	YES	NO
OERP-06	Does the utility have standard procedures for notifying state agencies, local health departments, the NPDES authority, the public, and drinking water authorities of significant overflow events?	YES	NO
OERP-07	Does the procedure include a current list of the names, titles, phone numbers, and responsibilities of all personnel involved?	YES	NO
OERP-08	Does the utility have a public notification plan?	YES	NO
OERP-09	Does the utility have procedures to limit public access to and contact with areas affected with SSOs? *(Procedure can be delegated to another authority)*	YES	NO
OERP-10	Does the utility use containment techniques to protect the storm drainage systems?	YES	NO

OERP-11 Do the overflow records include the following information? *(Check all that apply)*

- ☑ Date and time
- ☑ Location
- ☑ Any remediation efforts
- ☑ Cause s)
- ☑ How it was stopped
- ☐ Estimated flow/volume discharged
- ☑ Names of affected receiving water(s)
- ☑ Duration of overflow

OERP-12	Does the utility have signage to keep public from effected area?	YES	NO

Smoke and Dye Testing (SDT)

SDT-01	Does the utility have a smoke testing program to identify sources of inflow and infiltration?	YES	NO
SDT-01A	Does the utility have a smoke testing program to identify sources of inflow and infiltration in illegal connectors? It is contracted out.	YES	NO
SDT-01B	Does the utility have a smoke testing program to identify sources of inflow and infiltration in house laterals (private service laterals)?	YES	NO
SDT-02	Are there written procedures for the frequency and schedule of smoke testing?	YES	NO
SDT-03	Is there a documented procedure for isolating line segments?	YES	NO
SDT-04	Is there a documented procedure for notifying local residents that smoke testing will be conducted in their area?	YES	NO
SDT-05	What is the guideline for the maximum amount of the line to be tested at one time? *(Feet or Miles)*	1,000 ft	
SDT-06	Are there guidelines for the weather conditions under which smoke testing should be conducted?	YES	NO
SDT-07	Does the utility have a goal for the percent of the system smoke tested each year?	YES	NO
SDT-08	What percent of the system has been smoke tested over the past year?	0 %	
SDT-09	Do the written records contain location, address, and description of the smoking element that produced a positive result?	YES	NO
SDT-10	Does the utility have a dye testing program?	YES	NO
SDT-11	Are there written procedures for dye testing?	YES	NO
SDT-12	Does the utility have a goal for the percent of the system dye tested each year?	YES	NO
SDT-13	What percent of the main collection system has been dye tested over the past year?	<1 %	
SDT-14	Does the utility share smoke and dye testing equipment with another utility?	YES	NO

Hydrogen Sulfide Monitoring and Control (HSMC)

HSMC-01 How would you rate the systems vulnerability for hydrogen sulfide corrosion? *(Check only one)*

- [x] Not a problem
- [ ] Only in a few isolated areas
- [ ] A major problem

HSCM-02	Does the utility have a corrosion control program?	YES (circled)	NO
HSCM-03	Does the utility take hydrogen sulfide corrosion into consideration when designing new or replacement sewers?	YES (circled)	NO
HSCM-04	Does the utility have written procedures for the application of chemical dosages?	YES	NO (circled)
HSCM-05	Are the chemical dosages, dates, and locations documented?	YES	NO (circled)
HSCM-06	Does the utility document where odor is a continual problem in the system?	YES (circled)	NO
HSCM-07	Does the utility have a program in place for renewing or replacing severely corroded sewer lines to prevent collapse?	YES (circled)	NO

HSCM-08 Are the following methods used for hydrogen sulfide control? *(Check all that apply)*

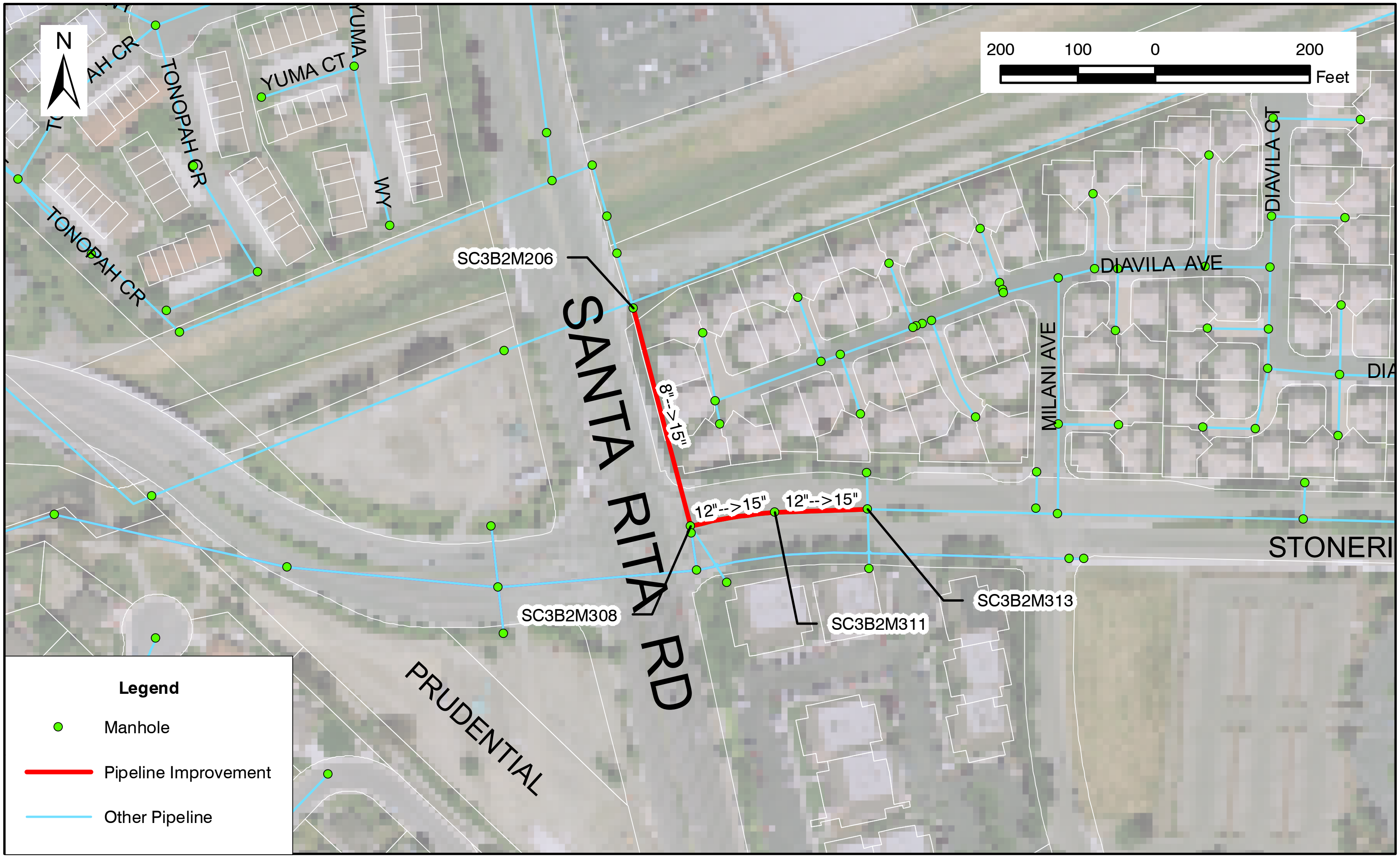
- [x] Aeration
- [ ] Iron salts
- [ ] Enzymes
- [x] Activated charcoal canisters
- [ ] Chlorine
- [ ] Sodium hydroxide
- [ ] Hydrogen peroxide
- [ ] Potassium permanganate
- [ ] Biofiltration
- [ ] Other

HSCM-09	Does the system contain air relief valves at the high points of the force main system?	YES (circled)	NO

HSCM-10 How often are the valves maintained and inspected? *(Weekly, Monthly, etc.)* Monthly

HSMC-11	Does the utility enforce pretreatment requirements?	YES	NO (circled)

APPENDIX L - CIP PROJECTS



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PROJECT 1A
SANTA RITA ROAD SEWER
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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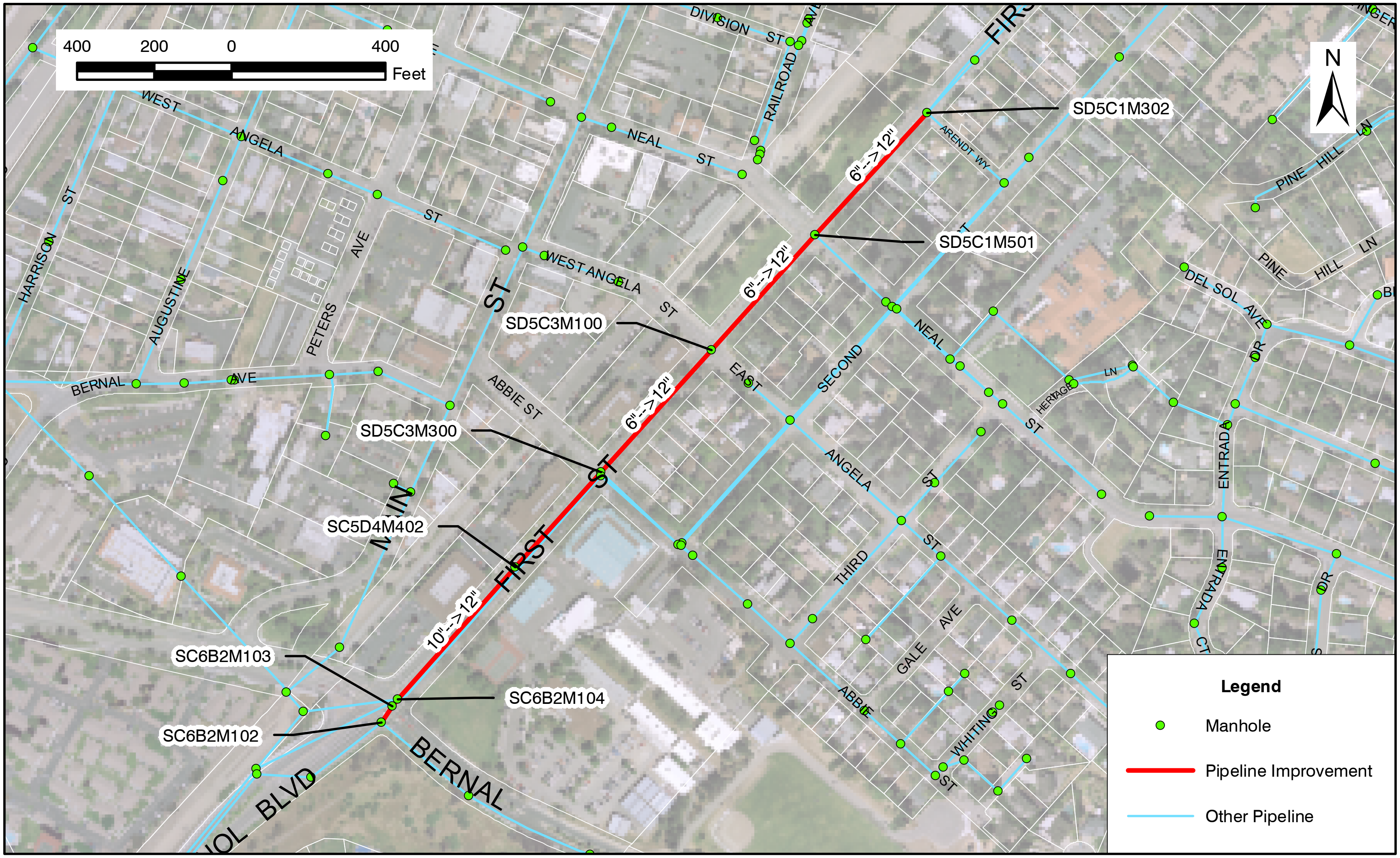
June 19, 2007

Project 1A - Santa Rita Road Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
SC3B2P313311	SC3B2M313	SC3B2M311	12	15	2B	324.10	323.25	121
SC3B2P311308	SC3B2M311	SC3B2M308	12	15	2B	323.25	322.95	110
SC3B2P308206	SC3B2M308	SC3B2M206	8	15	2B	322.92	322.16	291



PROJECT 1B
FIRST STREET SEWER
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 19, 2007

Project 1B - First Street Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
SD5C1P302501	SD5C1M302	SD5C1M501	6	12	5E	348.04	343.00	432
SD5C1P501100	SD5C1M501	SD5C3M100	6	12	5E	343.00	340.49	398
SD5C3P100300	SD5C3M100	SD5C3M300	6	12	5E	340.49	337.80	427
SD5C3P300402	SD5C3M300	SC5D4M402	10	12	5E	337.80	332.91	330
SC5D4P402104	SC5D4M402	SC6B2M104	10	12	5D	332.91	326.10	460
SC6B2P104103	SC6B2M104	SC6B2M103	10	12	5D	326.10	325.94	23
SC6B2P103102	SC6B2M103	SC6B2M102	10	12	5D	325.84	325.70	50

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PROJECT 1C
REBUILD PUMP STATION S-6
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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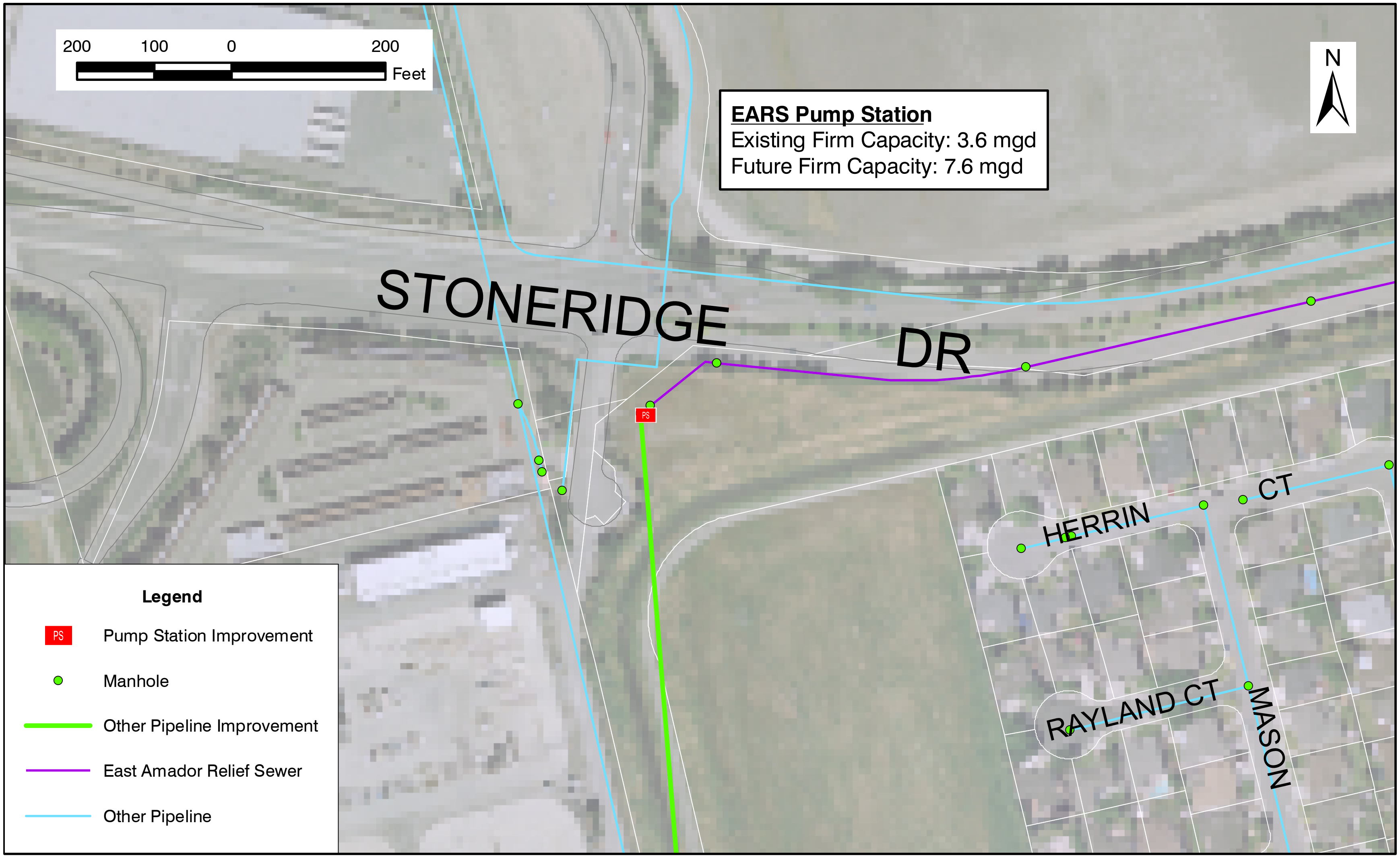
June 19, 2007



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PROJECT 1D
EARS PUMP STATION
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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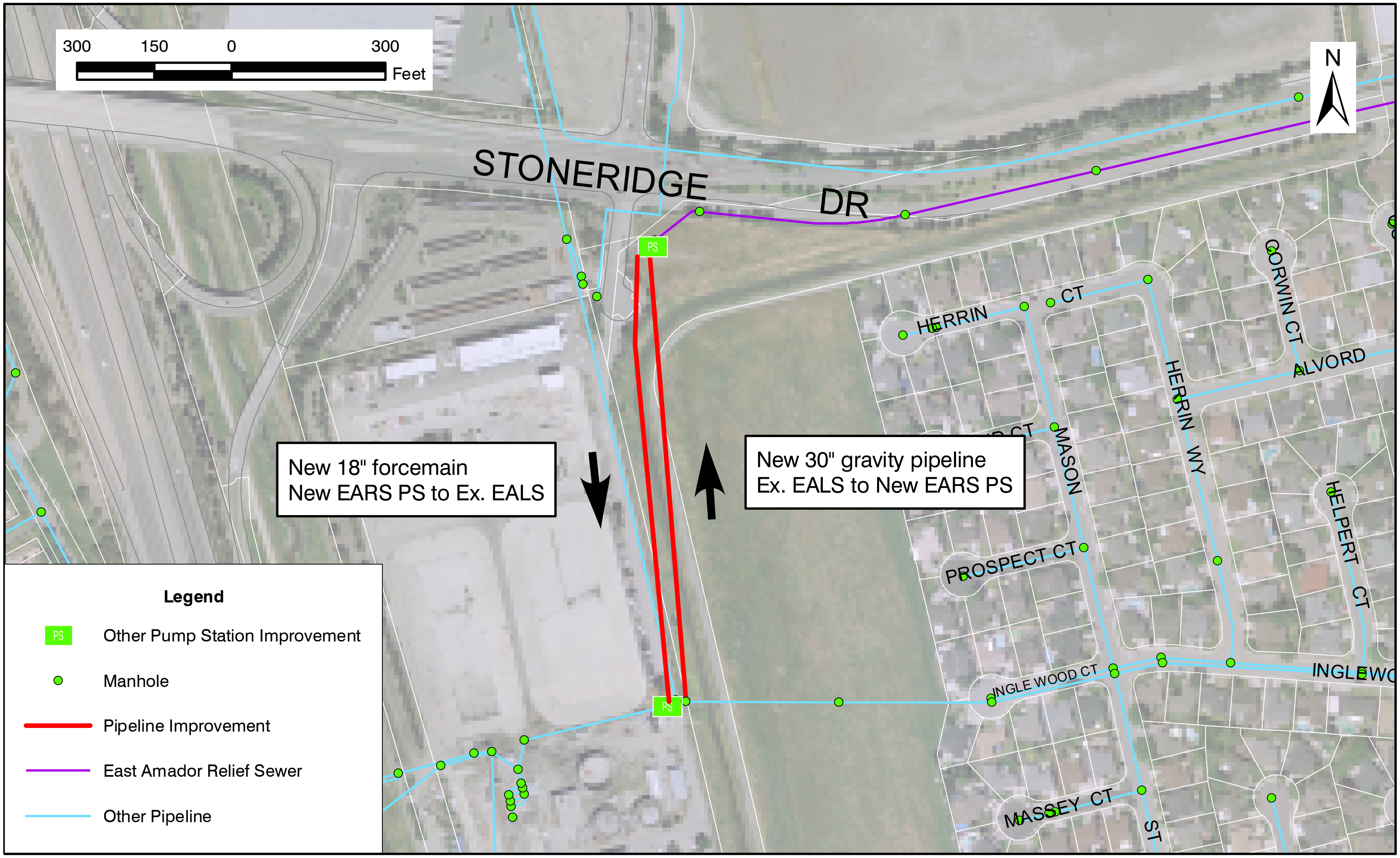
June 19, 2007



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PROJECT 1E
EARS CONNECTOR SEWER
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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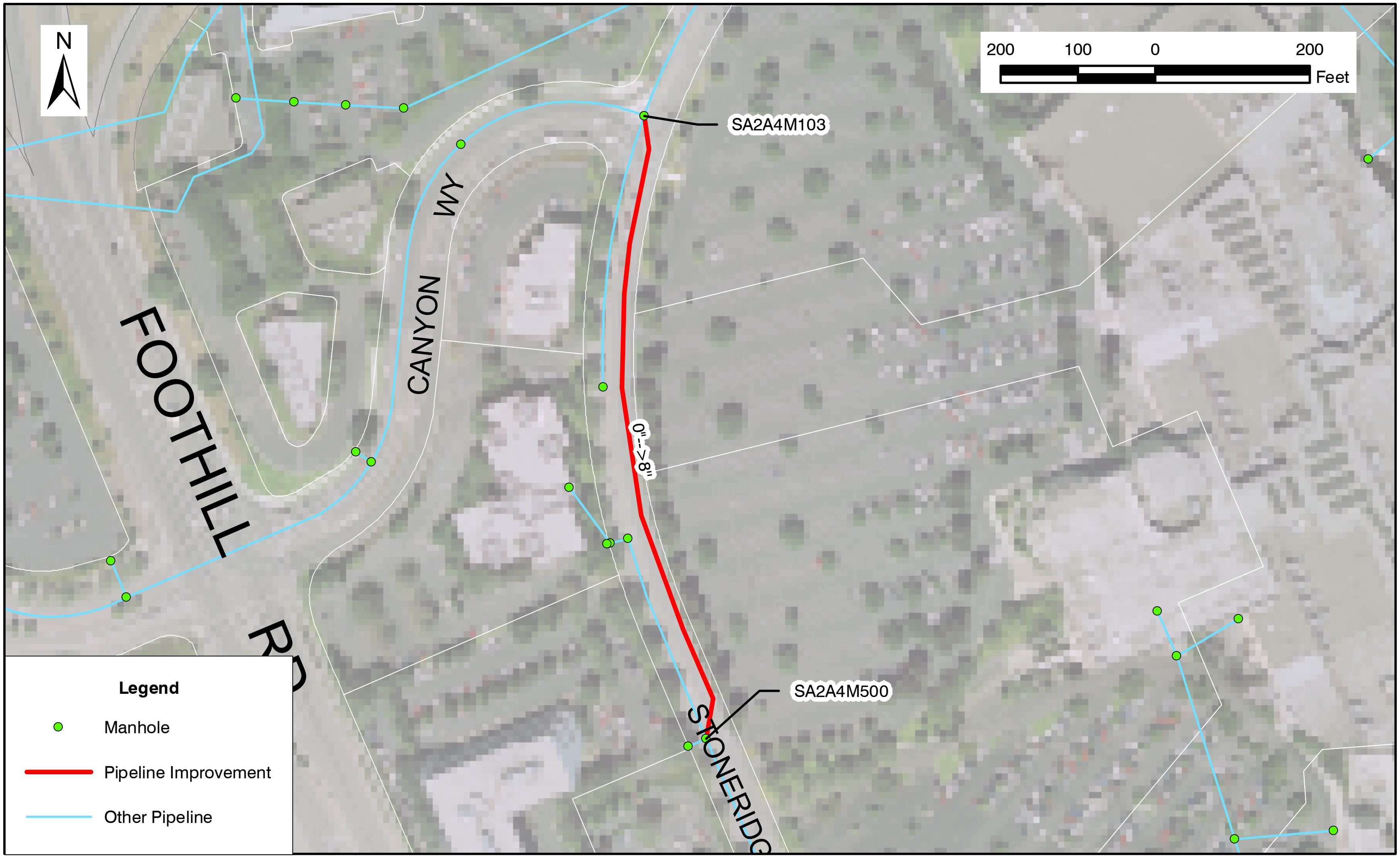
June 19, 2007

Project 1E - EARS Connecter Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
New Forcemain	EARS PS	EALS	---	18	2A	---	---	800
New Gravity	EALS	EARS PS	---	30	2A	---	---	800



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PROJECT 2A
STONERIDGE MALL BYPASS
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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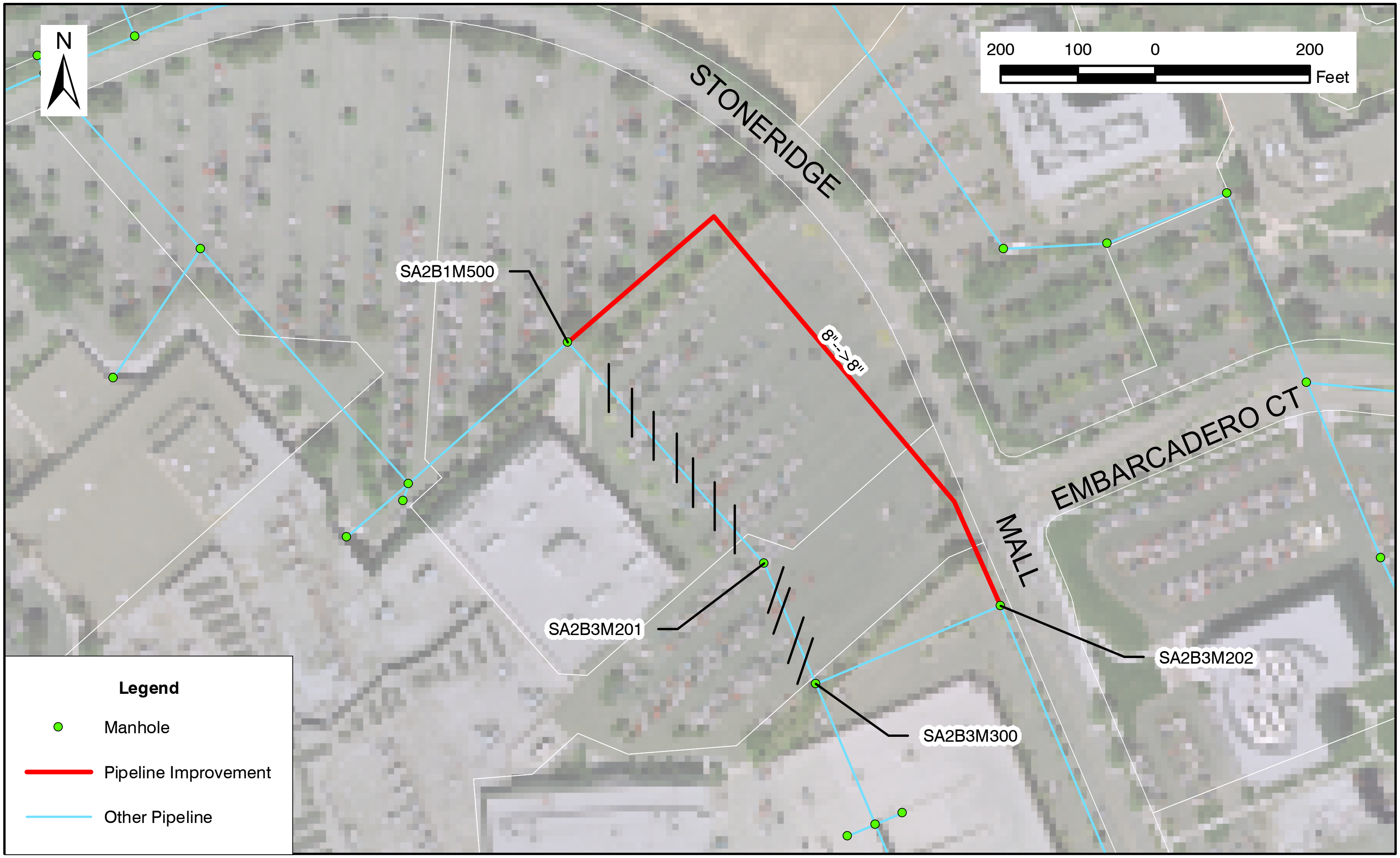
June 19, 2007

Project 2A - Stoneridge Mall Bypass

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
New Pipe	SA2A4M103	SA2A4M500	---	8	1	346.66	345.29	850



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PROJECT 2B
NORDSTROM SEWER
WASTEWATER SYSTEM MASTER PLAN
CITY OF PLEASANTON

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June 19, 2007

Project 2B - Nordstrom Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
New Pipe	SA2B1M500	SA2B3M202	---	8	1	329.54	327.84	860

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PROJECT 2C
KAMP DRIVE SEWER
WASTEWATER SYSTEM MASTER PLAN
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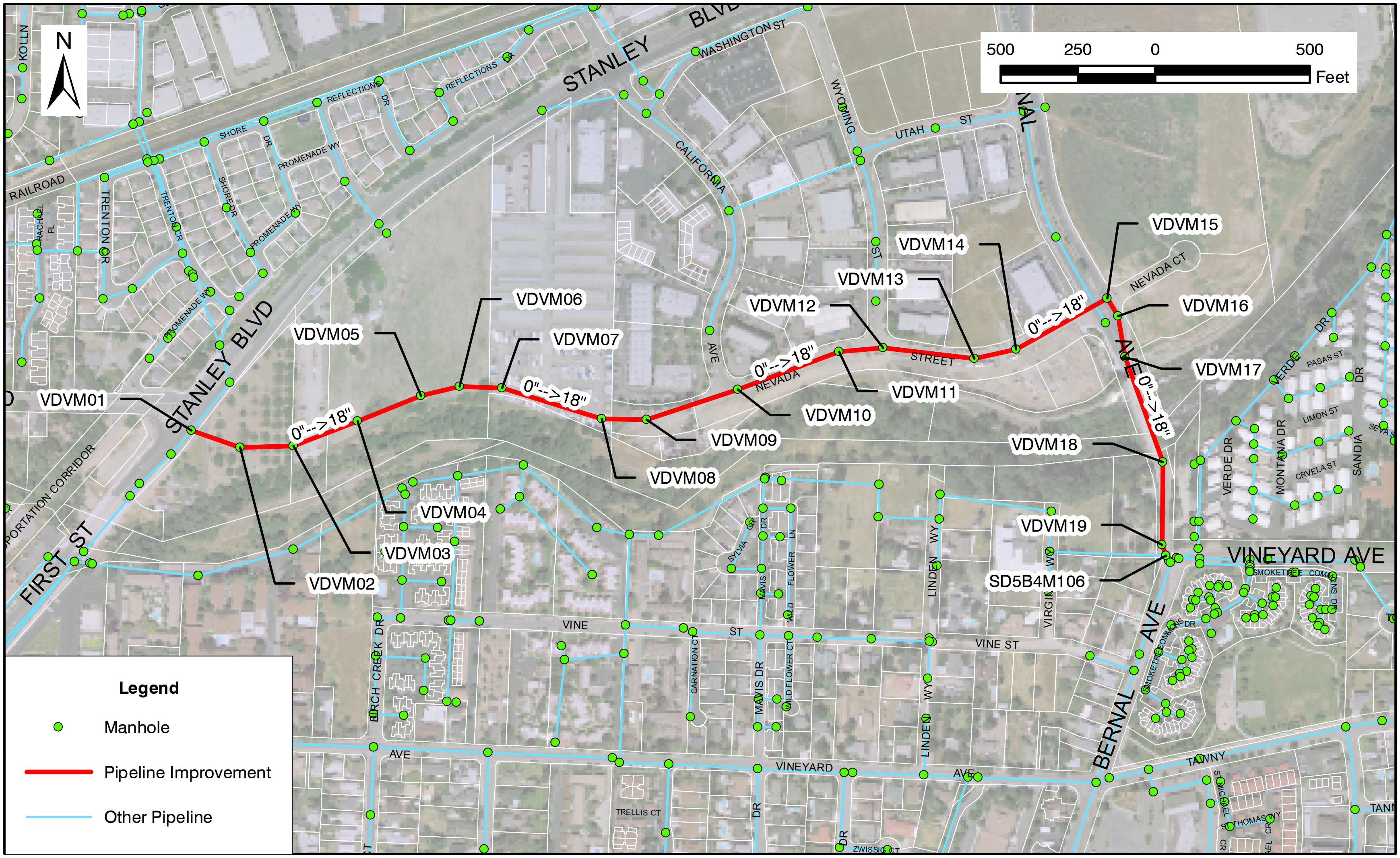
Project 2C - Kamp Drive Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
SD3D3P305302	SD3D3M305	SD3D3M302	8	10	2B	342.20	341.76	146
SD3D3P302305	SD3D3M302	SD3C4M305	8	10	2B	341.76	341.00	253
SD3C4P305203	SD3C4M305	SD3C4M203	8	10	2B	341.00	340.35	217
SD3C4P203105	SD3C4M203	SD3C4M105	8	10	2B	340.35	339.53	239



PROJECT 2D
VINEYARD SEWER
WASTEWATER SYSTEM MASTER PLAN
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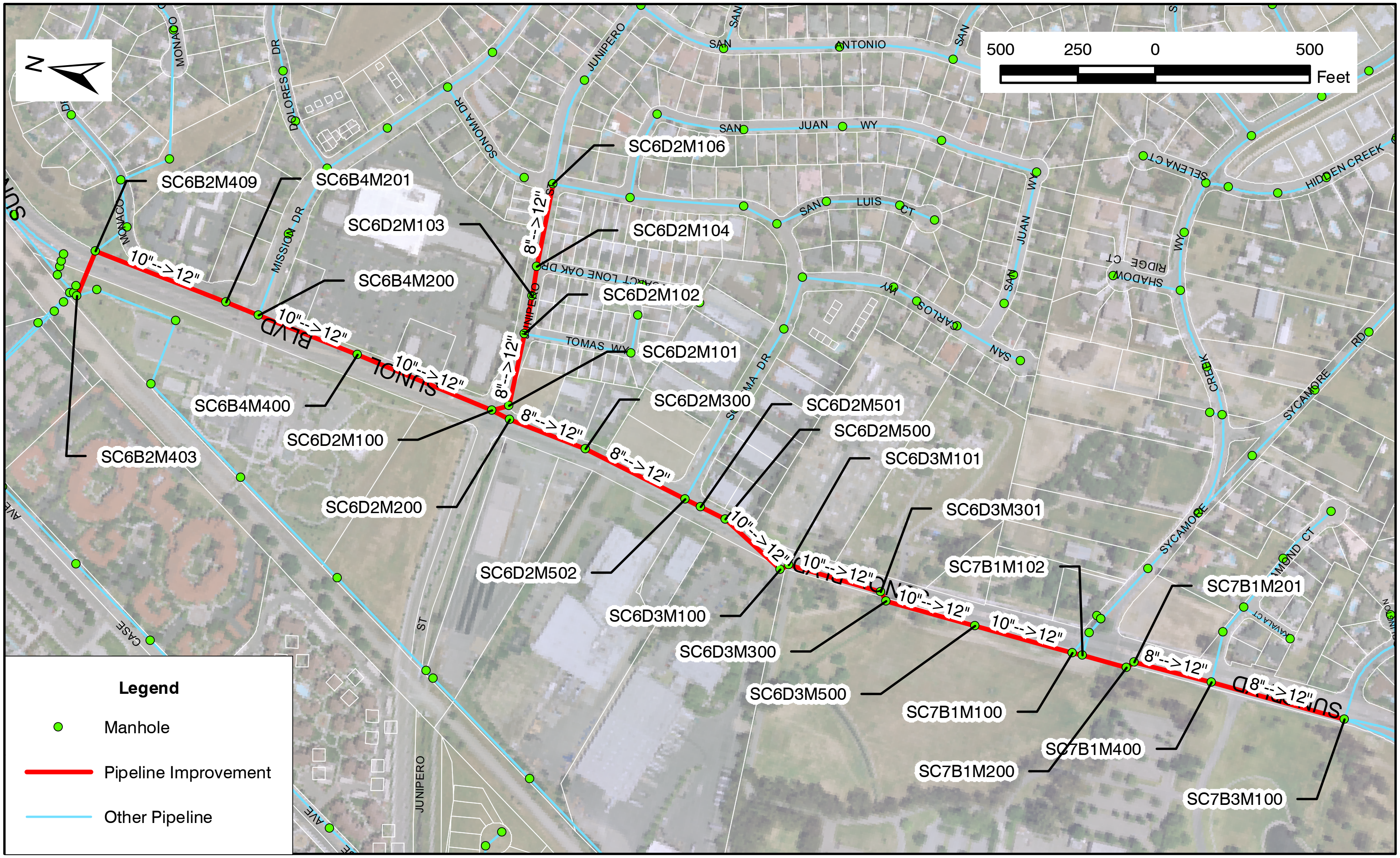
Project 2D - Vineyard Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
VDVP19	SD5B4M106	VDVM19	---	18	4D	355.20	355.10	34
VDVP18	VDVM19	VDVM18	---	18	4D	355.10	354.70	268
VDVP17	VDVM18	VDVM17	---	18	4C	354.70	354.00	363
VDVP16	VDVM17	VDVM16	---	18	4C	354.00	353.60	135
VDVP15	VDVM16	VDVM15	---	18	4C	353.60	353.40	66
VDVP14	VDVM15	VDVM14	---	18	4C	353.40	352.50	337
VDVP13	VDVM14	VDVM13	---	18	4C	352.50	352.10	140
VDVP12	VDVM13	VDVM12	---	18	4C	352.10	351.30	297
VDVP11	VDVM12	VDVM11	---	18	4C	351.30	350.90	144
VDVP10	VDVM11	VDVM10	---	18	4C	350.90	350.00	350
VDVP09	VDVM10	VDVM09	---	18	4C	350.00	349.20	310
VDVP08	VDVM09	VDVM08	---	18	4C	349.20	348.80	143
VDVP07	VDVM08	VDVM07	---	18	4C	348.80	347.90	338
VDVP06	VDVM07	VDVM06	---	18	4C	347.90	347.50	137
VDVP05	VDVM06	VDVM05	---	18	4C	347.50	347.20	128
VDVP04	VDVM05	VDVM04	---	18	4C	347.20	346.60	222
VDVP03	VDVM04	VDVM03	---	18	4C	346.60	346.00	222
VDVP02	VDVM03	VDVM02	---	18	4C	346.00	345.50	173
VDVP01	VDVM02	VDVM01	---	18	4C	345.50	345.42	166



PROJECT 3A
SUNOL BOULEVARD SEWER SEWER
WASTEWATER SYSTEM MASTER PLAN
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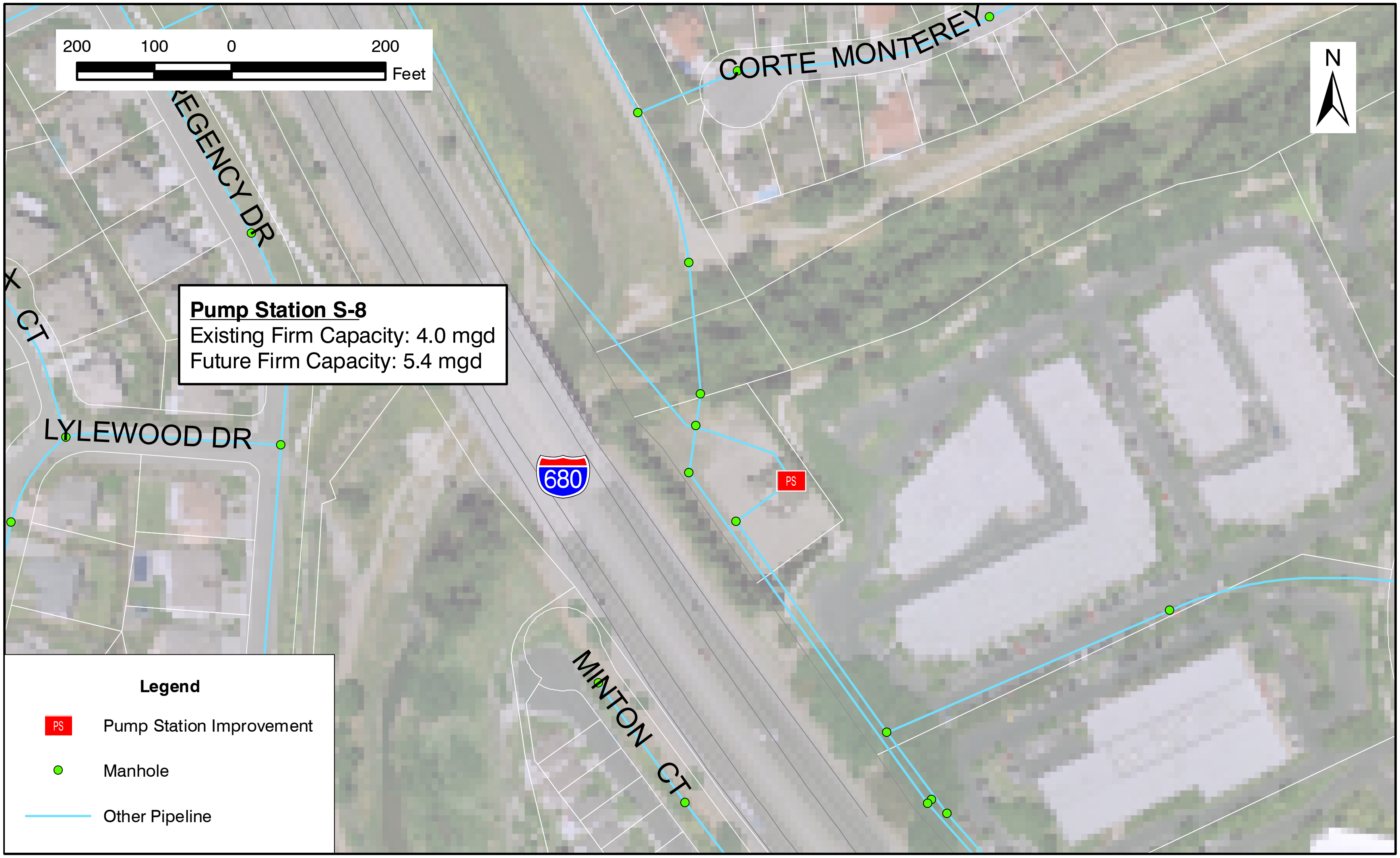
Project 3A - Sunol Boulevard Sewer

ID	Upstream Manhole	Downstream Manhole	Existing Diameter	Future Diameter	Subbasin	Upstream Invert	Downstream Invert	Length
			(Inches)	(Inches)		(Feet)	(Feet)	(Feet)
SC7B3P100400	SC7B3M100	SC7B1M400	8	12	5D	363.44	361.65	450
SC7B1P400201	SC7B1M400	SC7B1M201	8	12	5D	361.65	359.26	254
SC7B1P201200	SC7B1M201	SC7B1M200	8	12	5D	358.91	357.03	35
SC7B1P200102	SC7B1M200	SC7B1M102	8	12	5D	357.03	348.19	177
SC7B1P102100	SC7B1M102	SC7B1M100	27	12	5D	348.19	348.00	34
SC7B1P100500	SC7B1M100	SC6D3M500	10	12	5D	348.00	346.92	328
SC6D3P500300	SC6D3M500	SC6D3M300	10	12	5D	346.92	345.93	297
SC6D3P300301	SC6D3M300	SC6D3M301	10	12	5D	345.93	345.73	33
SC6D3P301101	SC6D3M301	SC6D3M101	10	12	5D	345.73	344.69	313
SC6D3P101100	SC6D3M101	SC6D3M100	10	12	5D	344.69	339.26	33
SC6D3P100500	SC6D3M100	SC6D2M500	10	12	5D	339.26	337.87	241
SC6D2P500501	SC6D2M500	SC6D2M501	10	12	5D	337.87	337.60	90
SC6D2P501502	SC6D2M501	SC6D2M502	8	12	5D	337.60	336.90	55
SC6D2P502300	SC6D2M502	SC6D2M300	8	12	5D	336.90	322.70	362
SC6D2P300200	SC6D2M300	SC6D2M200	8	12	5D	322.70	317.50	263
SC6D2P106104	SC6D2M106	SC6D2M104	8	12	5D	320.81	319.44	270
SC6D2P104103	SC6D2M104	SC6D2M103	8	12	5D	319.44	318.96	100
SC6D2P103102	SC6D2M103	SC6D2M102	8	12	5D	318.96	318.47	120
SC6D2P102101	SC6D2M102	SC6D2M101	8	12	5D	318.47	317.16	236
SC6D2P200100	SC6D2M200	SC6D2M100	8	12	5D	317.50	316.13	67
SC6D2P101100	SC6D2M101	SC6D2M100	8	12	5D	317.16	316.13	54
SC6D2P100400	SC6D2M100	SC6B4M400	10	12	5D	316.13	314.53	470
SC6B4P400200	SC6B4M400	SC6B4M200	10	12	5D	314.53	313.41	343
SC6B4P200201	SC6B4M200	SC6B4M201	10	12	5D	313.41	313.04	115
SC6B4P201409	SC6B4M201	SC6B2M409	10	12	5D	313.04	311.33	453
SC6B2P409403	SC6B2M409	SC6B2M403	12	12	5D	311.33	310.97	140



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PROJECT 3B
UPGRADE PUMP STATION S-8
WASTEWATER SYSTEM MASTER PLAN
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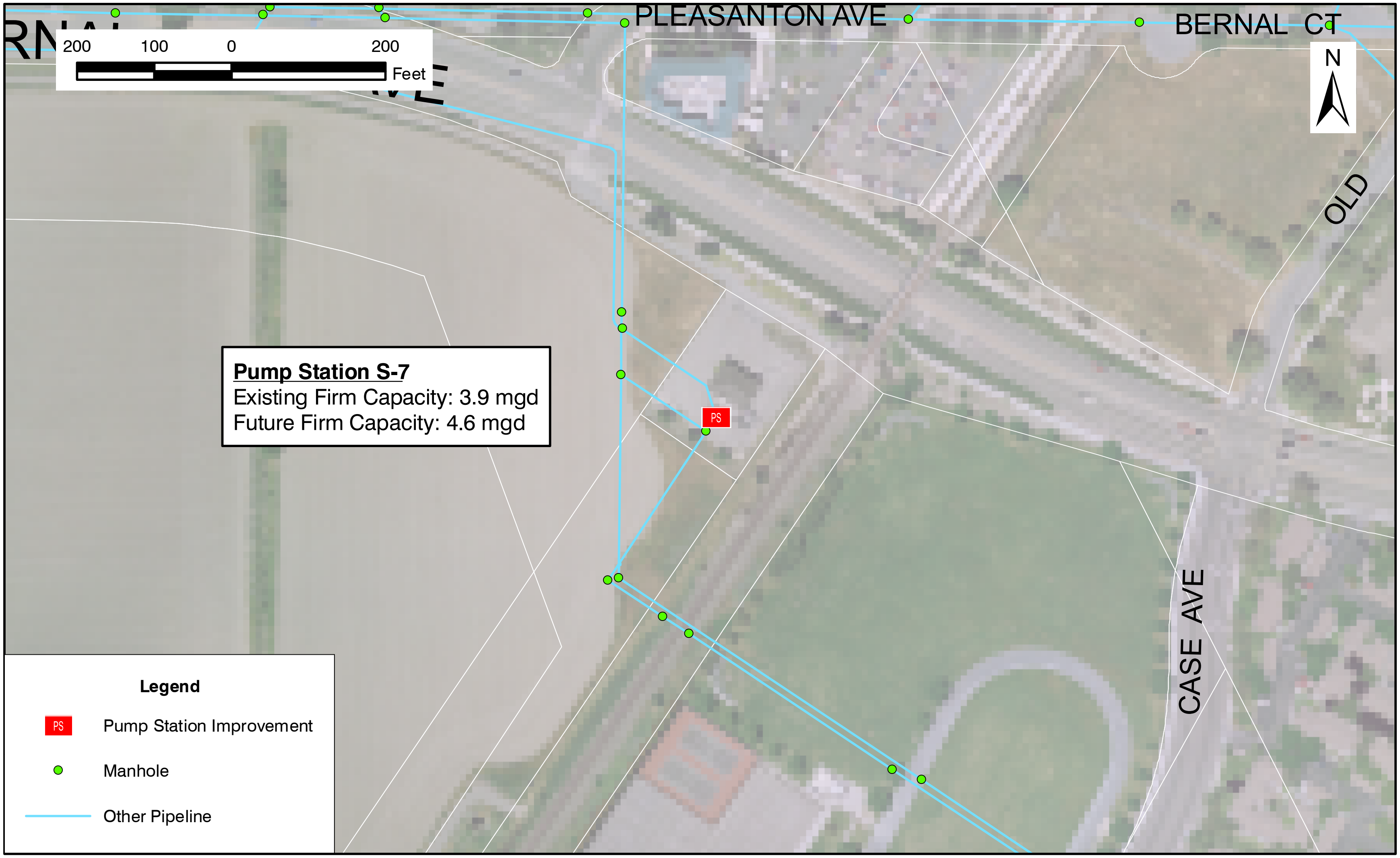

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PROJECT 3C
UPGRADE PUMP STATION S-7
WASTEWATER SYSTEM MASTER PLAN
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